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THE ELECTRIC LIGHT AT CHESTERFIELD.

We learn, through the columns of the *Derbyshire Courier*, that the Chesterfield Town Council on Tuesday, the 10th inst., unanimously decided to adopt the recommendation of the Watch Committee in favour of applying for a licence to supply electricity for public and private purposes within the borough. At the meeting some of the many advantages derived from a local authority having the lighting of a district in its own hands were pointed out, and not a single member had anything to say against the proposal. The Council will not be required to spend anything in the purchase or maintenance of plant, but the Act gives power to a local authority to contract with any company or person for the supply of electricity in the area to which their licence extends. The Corporation would thus be bound to no particular system of electric lighting; they could require all wires to be placed underground; they could exercise a control over the breaking up and re-laying of the streets, and any profits which might be derived would go to relieve the rates.

The lighting of this town has been referred to on several occasions in the Electrical Review, and last week we published in our "Correspondence" columns a letter bearing upon the subject. It will be remembered that the Hammond Company contracted to light Chesterfield for a year, after an efficient trial, by means of "Brush" arc electric lamps and incandescence lamps of the Lane-Fox system.

Mr. Alderman Gee, who apparently takes a leading part in connection with this matter, recently ventilated his views in the *Standard*, and he came to the conclusion that the efforts of the Hammond Company were, to say the least, a failure, more especially as regards the incandescence lamps. He admitted, however, that the arc lights are doing good service in some of the streets. With these we do not intend to deal, as the lamps on the incandescence system claim most attention at present. The Mayor of Chesterfield, in the course of his remarks, spoke to the following effect:—"Some possessed an illuminating power which really surprised him, the amount of light they gave being equal to 15 or 16 candle-power, whilst other lamps were as low as five or six candle-power. That was the cause of very great disappointment. Those differences were not occasioned by the current of electricity passing through the lamps, because the same strength of current passed through all, but the difference was owing to the variety of the lamps used—variety as to their illuminating power. It was quite evident that the lighting of the town by the electric light had not succeeded to their expectation or to the expectation of the contractors."

There are to be found in these observations several points deserving of comment. It is to be feared that sufficient care is not exercised in selecting lamps to be used in installations of incandescence electric lighting. In nearly all cases it is thought that if all the lamps have the same resistance they should produce the same candle-power. This is, however, quite a mistaken idea, as a few words will show. Suppose we have a carbon filament of a definite length and sectional area, and having, say, a resistance of 100 ohms. A given strength of current will heat this filament to, for instance, 20 candle-power. Now it is highly probable that the next lamp we may select has a slightly shorter and thinner filament than the first, and still another may have a filament just a trifle longer and thicker, but both may have a resistance of 100 ohms. The same current, however, which passes through our first lamp, and which produces a light of 20 candles would, in the second case, produce more light, as the mass of carbon to be heated is less; but the third lamp would not give us so much illuminating power, because the mass of carbon to be heated is greater. Therefore, although incandescence lamps may all be brought to the same resistance, we shall get varying illuminating power for a given strength of current, unless we can be sure that the carbon filaments are of the same dimensions and character.

It must be remembered, however, that Mr. Hammond was extremely reluctant to use incandescent lamps at all, on the ground that they had only reached an experimental stage; and, as the Mayor observed on Tuesday, the installation at Chesterfield was the first ever made for public lighting, and the contractors had necessarily to proceed tentatively.

The Mayor remarked further, that "Incandescent lamps had never been employed for street lighting previous to their being used at Chesterfield. His impression was, considering the infancy of the electric lighting, that the company had done wonders. At the same time, he had to confess that they had not accomplished that which they had set out to accomplish, and that for which they had contracted. He believed, however, that they had demonstrated the fact that electric lighting for public purposes was possible; and it had been demonstrated over and over again that the electric light for private purposes was not only possible, but really very convenient, and it might be in a very few years cheaper than, and far superior to, gas."

That the Mayor's belief will shortly be verified seems highly probable. There is little fault to be found now with the lighting of the Holborn Viaduct by the Edison Company since the substitution of a good single lamp for two indifferent ones. Mr. Gordon is also just coming upon the scene with his present installation of 1,300 or more lamps of 22 candle-power each, and his machine, which is said to be capable of supplying 7,000 similar lamps. It is indeed unfortunate that the Lane-Fox lamps should have proved so unsatisfactory in actual practice, and it is doubly so when we take into consideration the fact that Mr. Hammond's contract did not allow him to substitute others. We hope that some information will be forthcoming to account for the poor show made by the Lane-Fox lamps, for on the Holborn Viaduct such variations of light as shown in the streets of Chesterfield is not at any time observable. That the people of Chesterfield as a body appreciate the electric light is certain in spite of Alderman Gee's disparaging

remarks, and it is eminently satisfactory to note that the Town Clerk read a memorial which set forth that lighting by electricity had now become an accomplished fact; that the memorialists believed the light generated by electricity to be the best at present produced; that it would be convenient to the memorialists to have their shops and dwelling-houses lit by means of electricity, and that they therefore submitted to the favourable consideration of the Council the desirability of steps being taken to secure such object. The Town Clerk added that the document was signed by between 300 and 400 highly-respectable inhabitants, headed by Dr. Carnegie.

The experience gained at Chesterfield will not be lost, and whether the local authorities retain their powers in their own hands or whether they employ contractors to do the work for them, we hope shortly to hear that the lighting of Chesterfield by means of electricity is an accomplished fact and a permanent one.

THE CHEMISTRY OF THE PLANTÉ AND FAURE ACCUMULATORS.

[From *Nature* of the 19th inst.]

PART IV.—*The Function of Sulphate of Lead.*

IN our previous communications on the chemistry of lead and peroxide batteries, we have frequently remarked on the formation of lead sulphate and its importance in the history of a cell.

In Part I.* we showed that the local action that takes place at first energetically between the metallic lead and the peroxide is gradually diminished by the formation of sulphate of lead.

In Part II.* we stated that in the original formation of a Faure cell, sulphate of lead is oxidated on the one plate, and reduced on the other. We also described an experiment in which two platinum plates were covered with lead-sulphate immersed in dilute sulphuric acid, and placed in the circuit of a galvanic current; the result being that "the white sulphate was decomposed to a large extent on each plate, the positive being covered with deep chocolate-coloured peroxide, the negative with gray spongy lead."

In Part III.* we showed that on the discharge of a cell, lead sulphate is the ultimate product on both plates.

It might naturally be inferred from our previous statements that in the re-charging of a cell, this lead sulphate would be oxidated on the one plate and reduced on the other, as in the original formation. This matter, however, has given rise to some controversy. All subsequent experimenters admit the *oxidation* of the lead-sulphate, but Dr. Oliver Lodge could not obtain any reduction of it when pure sulphate was employed. Sir William Thomson also, when experimenting with two platinum plates and layers of sulphate, obtained only a doubtful indication of reduced metal. The question as to whether the sulphate is reduced or not on re-charging a Faure cell is one of vital importance; for if the sulphate formed at each discharge accumulates on the positive plate it would clog up the space, and, what is perhaps worse, a fresh surface of the lead would have to be oxidated (or rather converted into sulphate) at each discharge. Thus the positive plate will be continually corroded, and its life will be limited.

We have already replied to Dr. Lodge in *Nature* (Vol. XXVI. p. 342), but we thought it desirable to repeat the experiment with the platinum plates, especially with a view to determine whether the reduction was effected slowly or with any rapidity. We fastened 20 grms. of the white sulphate upon a negative plate by binding it round tightly with parchment-paper, placed it vertically in the sulphuric acid, and passed a continuous current of somewhat under an ampère. The hydrogen was at no time wholly absorbed—indeed the greater part of it certainly escaped—but after a lapse of twenty-four hours, small patches of gray metallic lead became distinctly visible through the wet parchment-paper; and these gradually spread in an irregular manner. At the end of ten days it was found that the whole of the sulphate, except a few small patches on the surface, was reduced to a gray spongy mass. Although there could be no reasonable doubt that this was metallic lead, a portion of it was tested chemically, and proved to be such.

It thus appears that the *reduction* of the pure sulphate of lead is an absolute fact, although it does not take place so easily as the oxidation.

In an actual cell the sulphate of lead is of course mixed with other bodies. Thus in the formation of a Faure battery, the minium is converted by the sulphuric acid more or less completely into peroxide of lead and sulphate. We have already described an experiment in which 4,489 cc. of hydrogen were absorbed on a plate, the materials of which were capable of absorbing only 4,574, cc., if the whole sulphate as well as the peroxide was reduced. In our note-book we have the particulars of four other experiments made in each case with the same or nearly the same, amount of material, in which 4,199, 4,575, 4,216, and 4,387, cc. respectively were absorbed, although perhaps in not one of these cases was the experiment continued until the action was absolutely complete. As, however, it may be objected that the amount of sulphate produced upon these plates was an unknown quantity, we have in a recent experiment treated the minium in the first instance with a considerable amount of sulphuric acid. This gave us a mixture which, on analysis, was found to contain 18·5 per cent. of suphate of lead. This mixture, when submitted to the reducing action of a current yielded a mass of spongy lead that contained only a mere trace of sulphate.

As it seemed desirable fully to establish the fact that the sulphate of lead formed on the discharge of a cell is reduced in the subsequent charging, we took the quondam lead plate of a fully discharged cell, determined the proportion of sulphate to unaltered spongy lead, and submitted it to the reducing action of a current. The amount of sulphate on the plate before passing the current was found to be 51 per cent., but, after the passage of a current of about an ampère for 60 hours, not a trace of it remained.

Hence it may be concluded that, during the alternate discharging and re-charging of a Planté or Faure cell, sulphate of lead is alternately formed and reduced on the lead plate, and that the plate itself is not seriously corroded. It would, however, appear desirable not to allow the whole of the spongy lead to be reduced to sulphate during the discharge, for two reasons, viz.: (1) because the supporting plate stands a chance of being itself acted on if there is not a sufficient excess of spongy metal; and (2) because the presence of this excess tends to facilitate the reduction of the sulphate.

We have already shown that sulphate of lead is produced by the local action that takes place between the peroxide and its supporting lead plate during repose. The same local action also takes during the charging of the plate, as was pointed out in our second communication, and this sulphate is, in its turn, attacked by the electrolytic oxygen. In this way the absorption of oxygen in forming the negative plate ought never to come to an end. In order to see whether this was the case, we allowed an experiment to continue for 115 hours, although the main action was over in about 40 hours. For the last two days of the experiment, the amount of oxygen absorbed was pretty constant, being about 9 cc. per hour, which is equivalent to 0·24 grms. of sulphate of lead formed and oxidated. The whole charge on the plate was 40 grms. of peroxide. This local action also takes place during the discharge, as is evidenced by the sulphate of lead formed on the negative plate always exceeding in amount that formed on the positive plate.

Through this local action taking place during the formation of the cell, during repose, and during the discharge, the lead plate which supports the peroxide must be continually corroded more and more; and it is probably due to the insolubility of the sulphate formed that the destruction of this kind of secondary battery is so materially retarded in practice.

J. H. GLADSTONE.
ALFRED TRIBE.

* See ELECTRICAL REVIEW, pp. 21 and 211, Vol. X., and p. 64 of Vol. XI.

M. JABLOCHKOFF'S NEW ELECTRIC-MOTOR.

Some weeks since we drew attention to the fact that M. Paul Jablochkoff, during a visit to London, had submitted to the inspection of several scientific friends a new electro-motor of his own invention, at once simple and novel. We were enabled to view M. Jablochkoff's machine, but could not at the time publish any facts concerning the principles on which its construction was based. We are now, however, in a position to lay before our readers a few facts concerning the action of this apparatus.

It seems to be established, according to the experiments undertaken on various occasions upon the transmission of power to a distance, that the modern continuous current dynamo-electric machines—Gramme, Siemens, Bürgin, &c.—constitute very efficient electro-motors.

In fact, if they transform 50 per cent. of the power applied to them into electric energy, they are capable of furnishing also in effective work at least 50 per cent. of the electric energy which is supplied to them from terminal to terminal. This return, however, supposes a few secondary modifications in the dynamo-electric machines employed as motors—such, for example, as the arrangement of the brushes, which ought to be set behind the neutral line with respect to the direction of motion instead of in front.

The experiments made with the object of increasing the efficiency of the motor do not seem therefore justifiable, since this efficiency attains at present a figure which it would be difficult to surpass; but besides this question, there is another which it will suffice merely to state in order to make its importance appreciated. What is the actual price of a continuous current dynamo-electric machine capable of supplying $\frac{1}{10}$, $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{2}$, 1, 2, 3, &c., horse-power? Practice shows that the actual machines, for equal efficiency, are more economical in cost price as they become more powerful, but that they are very expensive when constructed to furnish the work of only a few kilogrammetres.

We may therefore seek, with little chance of success, for a small electro-motor giving a satisfactory efficiency and low-priced compared to the quantity of work which it can supply, though the problem to be solved has to some extent been effected by the Siemens armature as applied by Marcel Deprez, Trouvé, and by Griscom.

The principal cause of the high efficiency of the Gramme machine, employed as a motor, results from the fact that the changes of direction of the current, and the reversals of polarity, are produced by successive fractions, in a single section at the time, the magnetic force, which must be overcome, is therefore only felt to an inappreciable extent, and one can counteract its detrimental action by a suitable arrangement of the collecting brushes.

In the double T bobbin-motors of Siemens, the magnetic force is less than in the first motors of Froment, Larmenjeat, Page, Leroux, &c., by reason of the relatively small dimensions of the magnetic masses submitted to the alterations of polarity; this explains why the return from these motors is intermediate between that of the Froment apparatus and the present continuous current machines. There was one more step to advance in this direction by dispensing completely with the magnetic masses submitted to the changes of direction of the current.

At the International Exhibition of Electricity, in Paris, held in 1881, M. Bürgin, of Bâle, exhibited an apparatus founded on this principle, and of which the description was given in the Electrical Review of the 14th January, 1882 (Vol. X., p. 20), translated from *L'Electricien*. We reproduce it again in order that it may be studied side by side with that of M. Jablochkoff.

It consists of a core of iron, B (figs. 1, 2, and 3), wound round with wire, M, the convolutions of which are wound so as to complete a sphere. This core of iron turns on a horizontal axis, the wires, M, which are attached to the sections of a commutator, C, are traversed by a continuous current from the source of electricity (a battery or a dynamo-electric machine) and polarise the extremities of the core of iron, B, without reversing the polarities, notwithstanding the rotatory movement of the core.

The sphere formed by this core and the wire, M, turns inside a second sphere which is hollow and fixed, and on which is wound horizontally a second continuous wire attached to two brushes of the commutator, C.

In consequence of the reciprocal reaction which takes place between the fixed sphere, B, and the movable polarised core inside, and in consequence of the reversals of current produced in the outer sphere, a rapid rotatory movement is imparted to the core and its axis.

This motor is characterised by the following points:—

(1.) The movable part consists of an electro-magnet, the polarity of which is never reversed.

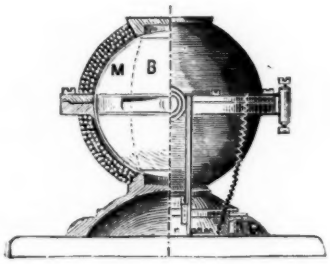

Fig. 1.

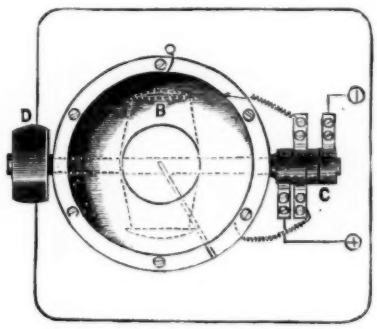

Fig. 3.

Bürgin's Electro-Motor.

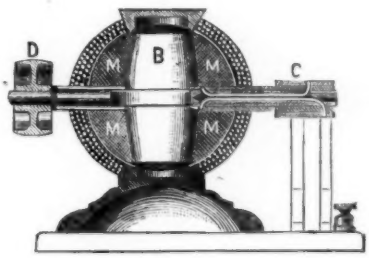

Fig. 2

(2.) The currents are reversed in the fixed part of the motor, and not in the movable part.

(3.) The movements are produced by the reciprocal action of a current and an electro-magnet, and not by the mutual attraction exercised by two electro-magnets.

There is, therefore, with this mode of construction, no magnetic inertia to overcome, since the system works without reversing the polarity of the core.

The motor of M. Paul Jablochkoff, of which we give an illustration (fig. 4) belongs to the same class as the Bürgin machine. It is composed of two bobbins, one fixed upon a horizontal axis in an inclined position, and turning with it; this bobbin is coiled upon a framework of iron, the cheeks of which form two circular poles (north and south), which, by the arrangement of the commutator, change their polarity twice in a revolution; the second bobbin is fixed in a vertical plane more or less inclined in relation to the horizontal axis of the revolving bobbin; it is coiled upon a non-magnetic frame, and the current which traverses it is continuous in direction. It is the relatively inclined position of the two bobbins which has given the apparatus the name of ecliptic, by reason of the analogy which this inclination presents to that of the ecliptic upon the equator.

The apparatus has arrangements for varying the inclination of the two bobbins so as to determine the best conditions for working; but in the motors for commercial purposes the position of the bobbins, determined once for all, will be fixed and invariable. When studying the mutual action between the movable electro-magnet upon its horizontal axis, which is submitted to the alterations of direction of the current, and the fixed solenoid in which a continuous current circulates, we see that there must result from it a

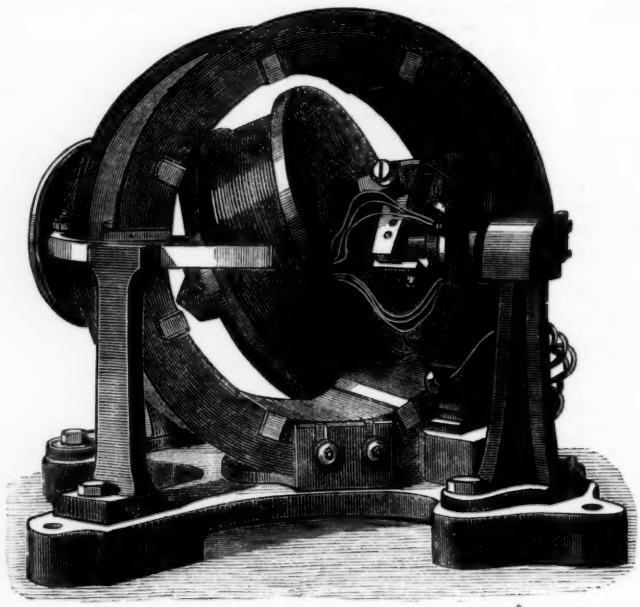

Fig. 4.

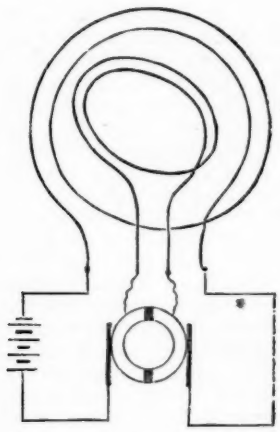

Fig. 5.

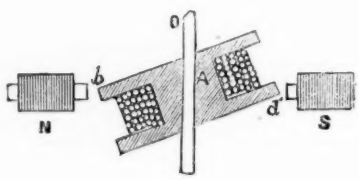

Fig. 6.

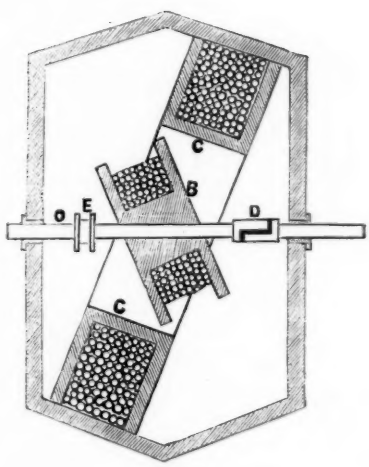

Fig. 8.

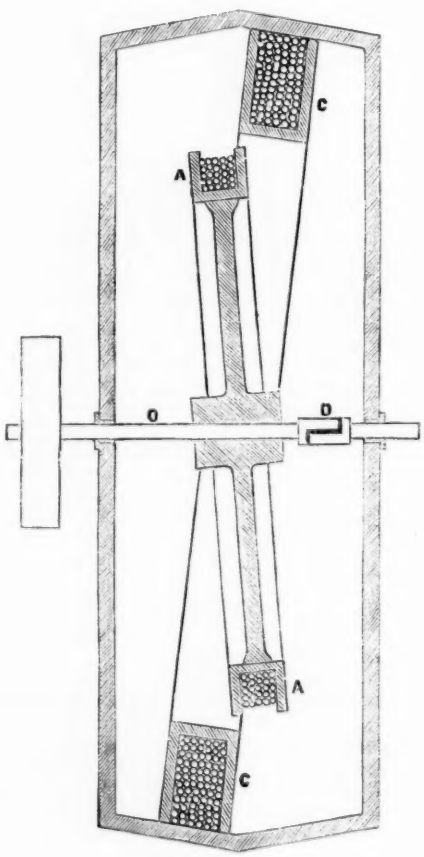

Fig. 9.

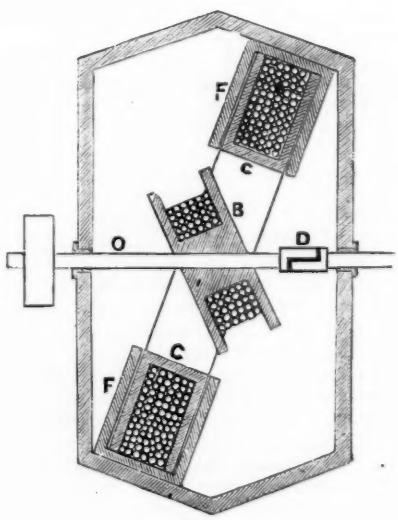

Fig. 7.

continuous and rapid motion of the axis of rotation, with the advantage resulting from the suppression of any magnetic mass in the fixed part.

It will be seen from the diagram of the Jablochkoff motor connections, fig. 5, how it differs from that of M. Bürgin. In the latter a kind of double commutator is employed, and the reversals take place in the fixed outside coil, whilst M. Jablochkoff uses an ordinary reversing commutator and changes the direction of the current in the revolving bobbin.

The Russian engineer's invention, however, relates to the construction and arrangement both of electro-dynamic and dynamo-electric machines in a simple form, or, in other words, his invention may be applied either in electro-dynamic machines—converting electricity into motive-power—or in dynamo-electric machines—converting motive-power into electricity ; and the following sketches illustrate some of the various arrangements proposed by the inventor. Fig. 6 is a diagram showing a simple form of machine :—A bobbin, A, having cheeks or flanges, *d b*, of soft iron, and wound with a coil of insulated wire, is fixed obliquely on an axis, O, and revolves between the poles of two electro-magnets, N S. The obliquity of the bobbin is such that, in each revolution, it presents the edges of *d* and *b* alternately to the poles of N and S, and alternating electric currents are set up in the coil of A. Fig. 7 shows a construction in which the bobbin, B, fixed obliquely on the axis, O, revolves within an oblique bobbin, C, which has an iron sheath, F, presenting interior polar edges toward the edges of B. The electric currents generated in the coil of B are collected and converted into currents of the same direction by means of a commutator, D. In the construction shown in fig. 8, the exterior bobbin is of soft iron. The commutator, D, may be applied to alternate the currents in the coil, C, those in the coil, B, being in the same direction, collected in the usual way by rubbers bearing on rings, E. In this case the internal bobbin, B, need not be of soft iron. When the machine is of large diameter, the interior bobbin, A, may be, as shown in fig. 9, merely a ring of iron fixed on a wheel of non-magnetic material. We have purposely omitted putting in the connections in these latter figures, as being unnecessary.

The advantages attached to these machines are several, and, amongst the more important, simplicity of construction takes the first place. The coiling of the wire is perhaps more easily performed than in any other machine, as it is all winding of the most direct character ; and the absence also of any nice adjustment constitutes a very important feature. M. Jablochkoff claims as his invention a dynamo-electric or electro-dynamic machine, wherein a magnetic coiled bobbin revolves between or within polar fields, the bobbin being fixed obliquely on its axis, so as to present its opposite edges to opposite fields alternately in each revolution, as described. We have seen the Jablochkoff motor at work in London, but we have no data yet as to its efficiency in comparison with those having magnetic inertia to overcome, and we shall therefore have occasion to return to this matter when the experiments undertaken by the *Maison Breguet*, in Paris, are completed.

GORDON'S ALTERNATING CURRENT MACHINE.

For six or eight months past the Telegraph Construction and Maintenance Company's mechanical department has been busily engaged in the manufacture of an enormous dynamo-electric machine, designed and patented by Mr. J. E. H. Gordon, a gentleman well known in the electrical world as the author of a work entitled "A Physical Treatise on Electricity and Magnetism." The machine which we are about to describe is an improvement upon that described in Mr. Gordon's Specification No. 78, 1881, both machines being of that class in which a ring or circle of electro-magnets is made to revolve between fixed rings or circles of similar electro-magnets.

In the machine described in the 1881 Specification the revolving rings each carry the same number of magnet coils as the fixed rings carry armature coils. The armature coils were made cylindrical and of the same diameter as the magnets, each being placed close to the next. The inventor found that these coils act on each other by mutual induction in a very injurious manner during the working of the machine, and that if a certain number of lamps are being maintained by one coil, then closing the circuit of the next to it on one side reduces the light of the lamps on the first by some 20 or 30 per cent.—closing the circuit of the next of the other side still further reduces it by a like amount. The reason given is that as the currents in contiguous coils circulate in opposite directions they are in the same direction in those parts of the two coils which are immediately contiguous to each other. As the currents in the two coils are both increasing at the same time they retard each other by their mutual action.

The diagram (fig. 1) will show the action of these coils one upon the other. A, A, are the armature coils, and N, S, S, N, &c., the revolving electro-magnets, and the arrows indicate the direction of the currents.

In the present machine this drawback is got rid of by making the number of armature coils *twice* the number of the magnet coils. The magnets therefore act alternately on the alternate set of coils. For instance, at the instant when the magnets are exerting their maximum action on the alternate coils, 1, 3, 5, and so on, the other alternate coils, 2, 4, 6, &c., are removed from their influence, and therefore are practically idle ; 1 and 5 still tend to act injuriously on 3 as before, but being separated from it by the thickness of coils 2 and 4, the inventor finds that their action is so small as to be unnoticeable ; 1 and 3 induce electromotive forces in the two sides of 2 respectively, but these are equal and in opposite directions, and so produce no current or change of current in 2.

This arrangement of the coils is shown in diagram, fig. 2, where the same letters correspond to the parts indicated in fig. 1. A general view of the new machine is shown in fig. 3. Mr. Gordon is a firm believer in the general adaptability of the electric light for all purposes, and this dynamo-electric machine—the magnitude of which will scarcely be apparent to the imagination—has been designed to take its place in a large central station for supplying light on a scale comparable with gas.

The revolving wheel, on which the inducing electro-magnets are placed, is built up of wrought-iron boiler-plates, and consists actually of two central discs, and of two cones whose bases fit upon the central discs, and through which the main shaft passes.

The discs and cones are made of segmental pieces of boiler plate, so cut that the grain of the plate is radial to the wheel at the centre of each segment. The segments are riveted together with butt strips, in the way usual in boiler making.

The discs are kept apart at the centre by a cast-iron distance-piece. At the rim they are kept apart by a wrought-iron ring. The cones are of less diameter than the discs, so as to leave a space of flat disc all round exterior to the cones. The cones and disc are separated at the centre by massive cast-iron bosses, turned square to the shaft where they butt against the disc, and conical where they butt against the cones. The cast-iron distance-piece is of somewhat larger diameter than the bosses, so that the discs can be riveted to it without the heads of the rivets interfering with the bosses. The cones, discs, ring, distance-piece, and bosses, are all firmly riveted and bolted together, being still further strengthened by angle-pieces placed between the disc and the cones.

The discs are riveted with double butt strips, the cones with single ones. The butt strips of the cones are placed inside them, and the rivet heads countersunk, so that the outsides of the cones have perfectly smooth surfaces.

The flat outer portion of the wheel receives the magnets.

Each magnet consists of a cylindrical iron core, and of two spools, of brass or other metal other than iron, containing wire, and of two pole-pieces. The core passes right through a hole in the discs and wrought-iron ring, and is fixed so as to project equally on both sides. The brass bobbins are then slipped on one at each side of the disc, and the pole plates being fixed on hold the bobbins in their places. The pole plates are of wrought iron, and their sides are not parallel, but form radii of the magnet wheel.

The shaft runs in bearings of phosphor bronze.

There is a large gap or opening in the sole plate of the machine, through which a portion of the wheel dips into a

pit below. This enables the centre of gravity to be kept low and greatly increases the stability of the machine.

The end thrust is taken by two loose iron collars, placed on the shaft, and pressed gently against the inside ends of the phosphor bronze journals by means of set screws projecting from the ends of the cast-iron bosses. These set screws are secured by lock nuts.

The collars also carry the contact rings for conveying the exciting current to the magnets. The rings are of phosphor bronze, and are separated from the iron collars by split rings of vulcanite or other insulator. Brushes press on them in the ordinary way, to convey the exciting current to them.

The stationary coils, in which the current is produced for the 64 poles facing the magnet-wheel are acted on by 32 magnet poles facing them, the number of stationary coils being twice the number of magnets as before stated.

The details of the fixed coils are shown in figs. 4, 5, 6.

The wedge-shaped core, N, consists of a sheet of boiler-plate bent upon itself so that the angle forms the thin end of the wedge and the free edges, which do not quite meet, form the thick end.

The wedge-shaped head of a T piece, O, is inserted into one end of the folded plate and welded to it, and the stem of the T being turned and screwed is passed through a hole in the fixed ring and is secured by lock nuts, O^1.

The wooden block, P, concerning the use of which we

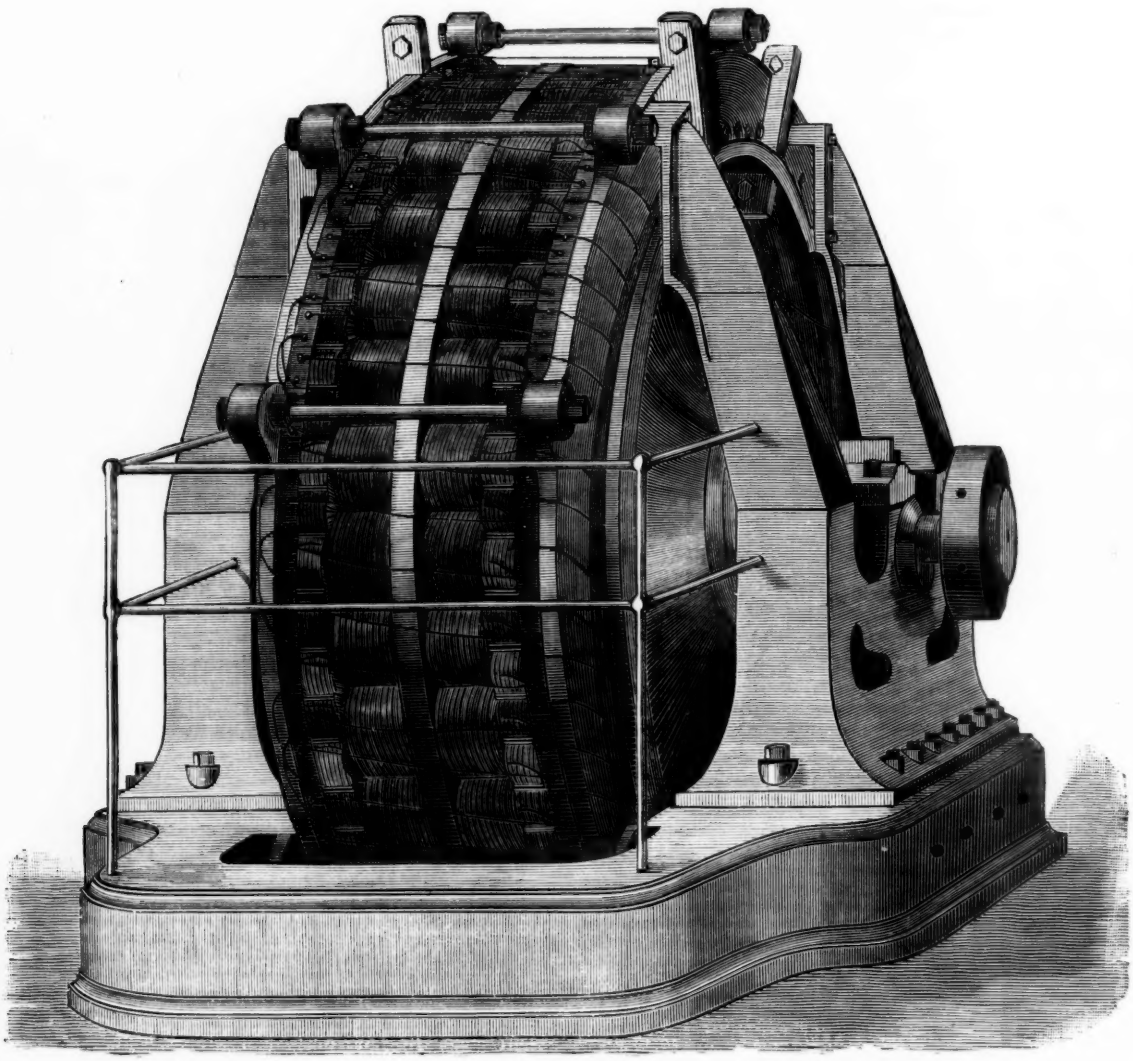

Fig. 3.

the lamps, are attached to fixed rings of cast iron. These rings are supported by being bolted to the inside of the gap in the sole plate and by four cast-iron struts. They are also tied together by seven screwed rods.

Each fixed ring is made in three segments, one being much smaller than either of the other two (the small segment will be seen at the top of the machine). This is for the reason that if one of the magnet coils breaks down it can readily be got at by removing the small segment of one of the fixed rings and turning the wheel until the damaged coil comes opposite to the gap so produced in the ring; the damaged coil can thus quickly be removed and replaced by another one.

Sixty-four fixed coils are attached to each ring, so that shall have more to say hereafter, is slipped on to the core and secured by one or more pins.

The German silver flange, Q, is riveted on to a shoulder cut on the end of the core. In addition to the slots which are cast in it a cut, Q^1, is made passing completely through into the opening of the core. Projecting lugs, Q^2, are cast on the German silver which clip into the opening in the core and prevent the slot, Q^1, from opening. The flange is further secured by being made to project beyond the wire in places, Q^3, and being secured to the wood by long screws and distance-pieces. These screws must of course be inserted after the wire is wound.

The flanges are thus constructed to check the circulation of currents, and German silver is the metal employed for

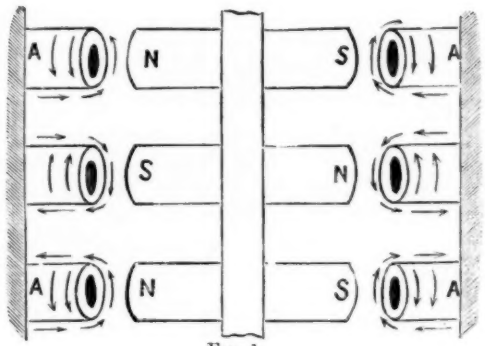

Fig. 1.

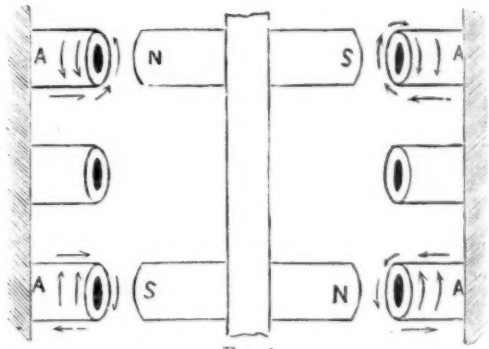

Fig. 2.

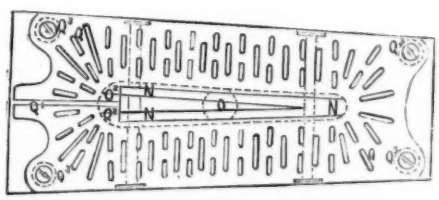

Fig. 4.

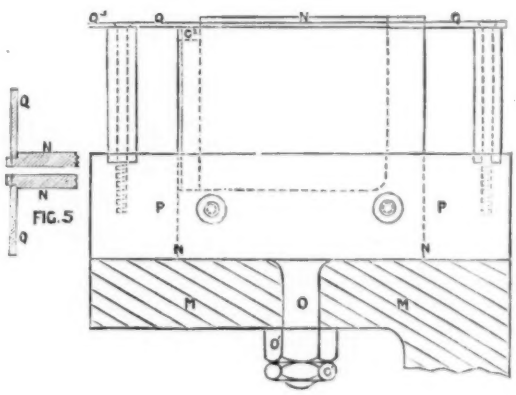

FIG.5

FIG.6.

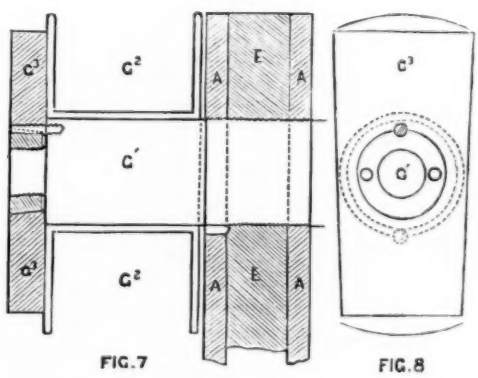

FIG.7

FIG.8

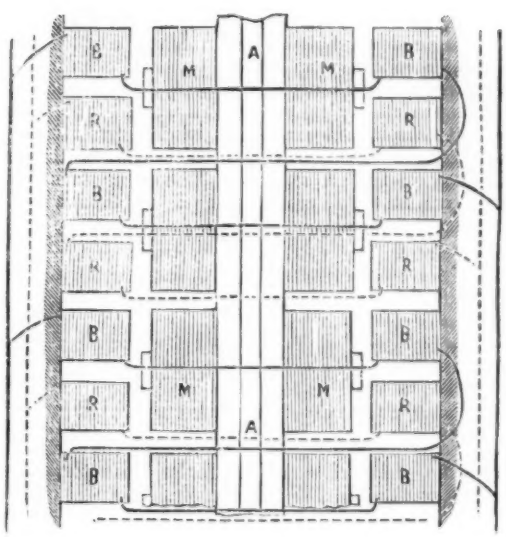

Fig. 9.

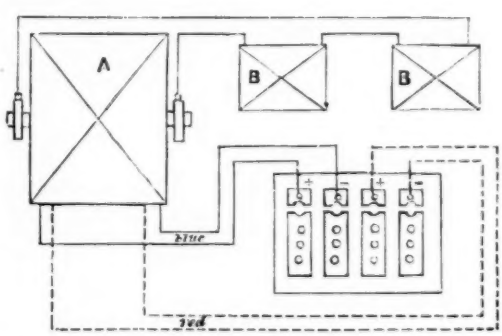

Fig. 10.

this purpose, as it is very rigid and opposes a high resistance to the circulation of currents in it. The use of the wooden block, P, is thus described by the inventor in his specification of December 17th, 1881 :—

"The connection of the outer ends of the cores of the coils on the outer rings I make by prolonging the cores outwards away from the magnet coil and securing them into a fixed iron ring-shaped plate, which forms their support."

"In order that power may not be wasted in inducing currents in this plate it is set back some distance, the cores being correspondingly prolonged. The space between the wire of the coils and the iron plate may be filled up with wooden plates or blocks which form the second flange of the coil, these wooden plates or blocks may be from one inch to three or more inches in thickness."

"This improvement may be applied to any machine where the inducing magnets act on one end of the iron cores of the armatures, whilst the other ends are secured to an iron plate or plates."

The actual distance (3 inches) between the side of the ring-shaped iron plates into which the cores of the stationary coils are screwed and the insulated wire surrounding the core has been mathematically determined by Mr. Gordon; and it is such, that while the coils receive the full benefit of the revolving electro-magnets, the inductive effect on the iron support of the armature coils is reduced almost to zero at any point, and the waste of power in heating, therefore, kept down to a minimum. Were it not for this arrangement the convolutions of wire on the armature coils would either have to be extended beyond the inductive influence of the electro-magnets, thus introducing useless resistance, or the supporting iron plates would be brought within it. Figs. 7 and 8 show the details of electro-magnet construction. G^1 is the cylindrical iron core, G^2 spool, and G^3 the pole-pieces. A and E show a portion of the discs and of the wrought-iron ring to which the electro-magnet cores are secured, so as to project on both sides. The total weight of this machine, which, by the way, is only regarded by Mr. Gordon and his associates as a model for others of enormously increased power, is 18 tons. The revolving electro-magnet wheel itself is of no less a weight than 7 tons, and its diameter is 8 ft. 9 in. The sole-plate of the machine measures 13 ft. 4 in. by 7 ft. Regarding the strength of this huge production of electrical engineering skill, Mr. Gordon informs us that when revolving at 140 revolutions per minute its factor of safety is 200, at 170 revolutions 140, and at 200 revolutions 109 approximately. The capstan, seen on the axle of the machine, is to enable the men in charge to turn it round by hand, should occasion arise.

This machine, now in operation at the works of the Telegraph Construction and Maintenance Company's Works at East Greenwich, is at present lighting only 1,300 Swan lamps of 20 to 22 stated candle-power each, but it is constructed to actuate 5,000 to 7,000 similar lamps with adequate driving power.

The engine now employed and which is coupled direct to the machine is a "picking-up" engine, taken from the company's cable ship *Calabria*, and as may be well understood, it is not particularly suited for this work. The present speed is 140 revolutions per minute, but 200 revolutions will be the speed when the new engines, which will take the place of that now in use, are complete. The connections of the machine are at the moment arranged as follows :—The electro-magnets are all connected up in series, and are excited by the current produced by two Bürgin machines driven by a separate engine, and also connected in series and giving a current in the electro-magnets of 19 ampères.

The armature or "taking off" coils, 128 in number, are connected, four coils in series, and the 32 sets in quantity, so that with 1,300 lamps, arranged two in series, the electromotive force is 105 volts and the current in each armature wire 29¼ ampères. All the armature coils are alternately blue and red, and this arrangement is carried out also in the main cables, there being two distinct circuits all over the works. The blue coils are connected to their particular conductor, and the red coils are treated in a similar manner. A sketch of armature coil connections is seen in fig. 9, where A represents the revolving wheel supporting the electro-magnets, M, M. The stationary blue coils are represented at B, and the red by R. The blue and red conductors are shown by the full and dotted line respectively.

Fig. 10 is a diagram representing the large machine, A, the exciter, B, and the switch arrangement, C, to which the current is led and then taken off from the terminals to the necessary points. A very important part of the installation is the photometer room, which might, perhaps, be more justly called the regulating room. The steam-pipes of both engines pass through this room, and in each pipe a stop-valve is placed, each having a large hand wheel connected with it, and under the immediate command of the attendant who watches the photometer screen. These stop-valves may, however, be actuated by a slow screw motion when it is desired to avoid sudden changes in the light, but this can be thrown out of gear instantly so as to allow the valve to be moved rapidly in case of accident. The following instruments are conveniently placed in this room so as to be under the observation of the man in charge: A steam gauge to indicate the boiler pressure, and a speed indicator to show at any moment the speed of the large dynamo. An ammeter of the Ayrton and Perry form is employed to show the exciting current, and the armature of the ammeter magnet is attached to a cover over the dial, so that when an observation is taken the armature must necessarily be taken off before the pointer can be seen. A short-circuiting key has also been attached to its terminals, kept closed when one is not actually taking an observation. An ordinary "shadow" photometer is arranged with a "Sugg's" standard candle, to compare with either a lamp belonging to the blue circuit or one from the red. These may be switched on or off when requisite, and they are attached to points on the circuit at a distance fairly representing that which might be selected as a test lamp in actual lighting operations on a large scale. The standard of illumination at which these indicating lamps are kept is as nearly as possible 22 candles. If there happened to be any great difference between the number of lamps on the red and blue circuits—no such difference will occur in practice, however, if the same class of house be put in each circuit—switches are provided by which street or other lamps near to the machine can be instantly transferred from one circuit to the other, 50 or 100 at a time, if a fine adjustment of the circuits is required.

Additional work being put upon the machine is shown immediately to the attendant by the decrease of speed and the diminution of candle-power in the indicating lamps, and is at once met by giving more steam to the engine. The method of starting is as follows :—The large machine is driven up to its normal speed unmagnetised, then the exciting "Bürgins" are slowly revolved, and the current produced by them circulating in the electro-magnets of the large machine reduces its speed. It is again driven up to 140 revolutions per minute, and the speed of the exciting machines still further increased, which again reduces that of the large machine. These operations are continued in this gradual manner until the lamps attain their normal candle-power, and the time taken up in attaining the desired result is usually about twenty minutes. The 1,300 lamps now in use are distributed over every part of the Telegraph Construction and Maintenance Company's Works, covering fourteen acres of ground, and it gives one a fair idea of the lighting by electricity of a small town. The lamps are arranged in the ordinary method, only instead of there being but single lamps between the conductors there are two, or in other words, they are arranged two in series. Some tests of Swan lamps were recently made by Mr. Willoughby Smith and his assistant, Mr. Perkins, at the Wharf Road Works, of the Telegraph Construction and Maintenance Company. It was desired to ascertain the electrical horse-power given to the lamps when at a luminosity of 19, 20, and 21 candles. The following table gives the results of these measurements :—

Swan Lamps tested at Wharf Road, October 10th, 1882.

Number of Lamp.	Candle-power to be.	Current through lamp in ampères.	Difference of potential at lamp. Volts.	Energy expended in lamp horse-power.	Number of candles per electrical horse power.
1	19	1·36	51	·093	204
1	20	1·41	52	·098	204
1	21	1·44	52	·100	210
2	19	1·31	52	·091	208
2	20	1·36	53	·096	201
2	21	1·41	53	·100	210

Indicator diagrams taken by the company's chief engineer and compared with the calculated electrical horse-power

show apparently that 94 per cent., and even more, of the indicated horse-power is reproduced in the lamps. We do not intend, however, entering into this question at present, although it is obvious that an error has crept in; this may possibly be Mr. Gordon's assumption on the strength of the foregoing tests, and the observations in his photometer room, that in every lamp one-tenth of a horse-power is expended.

A few additional items regarding the machine may interest our readers. The stationary and revolving coils are wound with No. 7 B.W.G. copper wire, and the resistance of the latter is 8 ohms, the coils being all joined up in series to suit the exciters. The resistance of each stationary bobbin is ·06 ohms, and the total resistance as the coils are at present joined up is roughly ·008 ohms. The weight of wire on each electro-magnet bobbin is 46 lbs., and that of each stationary coil 19 lbs. When Mr. Gordon has more engine-power at command and a larger number of lamps are employed the 128 fixed coils will be all connected up in quantity, and their resistance will then be only ·00047 ohms.

The electromotive force of the machine will be about 60 volts, and Swan lamps of a different resistance will then be used between the conductors singly, and not two in series as now.

It is intended that the machine when in full work with, say, 5,000 lamps, shall have an engine at each end. As it has been suggested that alternating currents passing in the streets would disturb telegraphic communication, the experiment has been made of lighting the cable tanks and test-rooms by means of it. The electricians report that no disturbance in the testing has been caused. This experiment, however, proves nothing, since the Thomson galvanometers used for testing purposes, although highly sensitive, are very sluggish in their action, and rapid alternating currents would not affect them; but these currents would powerfully affect a telephonic circuit, and, moreover, be quite capable of setting in vibration the tongue of a moderately sensitive polarised relay.

On Wednesday evening last, a number of gentlemen, at the invitation of Mr. Gordon and by permission of the Telegraph Construction and Maintenance Company, visited Greenwich for the purpose of inspecting the installation. They were afterwards entertained at dinner, and Sir James Anderson, in proposing Mr. Gordon's health, remarked that after having seen the machine he considered it a complete success. Mr. Gordon, in the course of his reply, dwelt on the necessity of having large central stations similar to our present gasworks, with large dynamos going at a very slow speed. They could then afford to pay a considerable sum for supervision when a large number of lamps were employed. He would like to see a much larger machine than his present one, and thought he would get great economy by having a revolving ring of 18 feet diameter, and turning at 60 revolutions per minute. Mr. Swan said he was pleased with what he had seen, and pointed to the close approach of the time when domestic electric lighting would become general. He thought the machine a grand success, and several other gentlemen also spoke on the subject in like terms.

The trial may be said to have been very satisfactory, and the effect of the Swan lamps in the various departments of the cable factory was extremely fine. Outside the buildings, however, the candle-power of the lamps seemed to vary to a considerable degree, and in many instances our surmise that one-tenth of a horse-power was not being expended in each lamp appeared confirmed. However, it is hardly within our province to criticise at present an exhibition which is little more than an experiment and concerning which we have no actual data removed from the possibilities of error. We congratulate Mr. Gordon on a success which promises well for the future of electric lighting by incandescence, and we shall follow with great interest further experiments with this, the most powerful and mechanically the best constructed machine yet seen. We may add that every facility and assistance has been afforded Mr. Gordon during the course of his labours by the Telegraph Construction and Maintenance Company.

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer, not necessarily for publication, but as a guarantee of good faith.

Letters, &c., for the "Correspondence" columns should arrive not later than Tuesday morning if they are desired to appear in the following number, such communications to be addressed to the "Editors," Electrical Review, 22, Paternoster Row, London, E.C.

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CORRESPONDENCE.

THE *TIMES* AND THE "FERRANTI" MACHINE.

To the Editors of The Electrical Review.

Sirs,—Dr. Lardner's dictum that no steam-ship could be built big enough to carry sufficient coals for a voyage across the Atlantic has become quite proverbial to indicate the failure to which learned as well as unlearned men are liable in prejudging the development of technical industry and the application of scientific principles. As another example of which you give in your impression of last week the opinion expressed in 1874 about the Gramme machine when introduced into England by Werdermann.

You very properly advise your readers with reference to the Ferranti dynamo machine, not "to put too much faith in any extravagant assertions which may have been spread abroad concerning the efficiency of the new dynamo;" and you propose to reserve your definite opinion on the machine until "we have had the opportunity of seeing and examining it." Quite so! Although you state that you "can safely say that the invention is something more than a modification in minor details," you express yourself in guarded language.

Now I maintain, Sirs, that we are not in the same position as Dr. Lardner was when he judged his big ship. We have built dynamos of every conceivable form, and are fully conversant with the principles which govern their action, know how to measure their efficiency, and we know that simply the question of supply and demand, besides monopoly, determines their cost.

But however enlightened your readers may be on this subject, thanks greatly to the information contained in your columns, how about the general public? Will the every-day reader of the daily paper—say, the educated reader of the *Times*—be in a position to judge between "essential differences" and "modifications in minor details?" Will this educated reader know how far to accept as correct the statement (as contained in the *Times* money article of September 22nd), that this new wonderful machine, the joint or simultaneous invention of Sir William Thomson and Mr. Ferranti, "can be manufactured for one-fifth the cost of the cheapest dynamo at present before the public" because "the great feature in the new machine is the

absence of iron in the revolving armature" (*sic*) and "the increased efficiency is aided by the absence of the commutator?" Perhaps the educated "investing" reader possesses shares in one or the other of the Electric Light and Power Companies, and not being an "Electrical Scientist," will rush to his stockbroker to part with his shares, since he may be of the same opinion as Mr. Pertwee, who, at the end of his remarkable letter in the money article of the *Times* of October 2nd says, with regard to the efficiency of the Ferranti machine . . . "the new patents" . . . "will, *if expectations be realised*, virtually have the effect of setting aside completely the present property."

Your space is too valuable to reprint the whole paragraph contained in the money article of the *Times* of September 22nd, but I would advise you and your readers to peruse the same; to learn how far "Jupiter of Printing House Square" can raise the wind on a scientific question, or to speak plainer, on a proposed industrial undertaking. The information conveyed in the paragraph is qualified by such expressions as "*we understand*"—"*it is stated*"—"*we are informed*," whilst the prospective picture drawn of this machine is based on two scientific principles well known to, and practically applied by, electricians for some years now.

You and your readers will, I doubt not, agree with me, that in the face of the fact that little or nothing is known of or about the Ferranti machine, such language in the *Times*, as coming from its editor, is not only *misleading* but highly *injudicious*—nay, *reprehensible*.

We all believe in the improvement and simplification of the dynamo machine, but to advance unqualified statements on hearsay—on questions, too, about which the general reader is not competent to judge—savours of a proceeding which we should think has been played out in the late "Electric Light Bubble."

I have no endeavour to decide either for or against the Ferranti machine, but simply wish to protest against *public opinion being influenced by a leading paper on a financial question relating to an* UNTRIED INVENTION, and I believe I shall be supported by every right-minded man.

Yours faithfully,

MORE LIGHT.

[At one moment our correspondent speaks of the paragraph in question as being qualified, and shortly afterwards to its being unqualified. This is at least somewhat contradictory.—Eds. Elec. Rev.]

ELECTRIC LIGHTING.

To the Editors of The Electrical Review.

Sirs,—In addition to the discussions on the merits of rival dynamo machines and lamps, the public is likely to be further distracted by the claims of patentees to the sole right of doing everything in connection with electric lighting.

Mr. Edison disputes the right of any one to use incandescent lamps other than those covered by his patents, and now Mr. Lane-Fox claims the privilege of lighting by a plan combining the use of dynamo machines, secondary batteries, and incandescent lamps in multiple arc.

This company gives to the world a better method of doing the same thing by secondary batteries, *in series*, and lamps from these series in multiple arc.

All these claims and differences among the doctors will probably cause Town Councils and other local authorities to pause before embarking upon the business of electric lighting under Board of Trade licences or Provisional Orders, and leave the development of the enterprise in the hands of the various patentees and their concessionaires.

Yours faithfully,

GEO. OFFOR,

Manager, the South-Eastern (Brush) Electric Light and Power Company (Limited).

London, *October 21st*, 1882.

LANCASHIRE AND CHESHIRE TELEPHONIC EXCHANGE COMPANY (LIMITED).

To the Editors of The Electrical Review.

Gentlemen,—With reference to the article in your issue of 21st inst. on this company and the trunk rates between towns.

These are not, as you suppose, fixed by us but by the Postmaster-General, who runs the wires and receives the whole of the moneys accruing, less £5 per subscriber, which he returns to us for terminal charges.

Needless to say this rebate is not sufficient to cover current expenses in connection with the manipulating of the wires, and instead of being gainers, we are losers by the transaction.

From the above you will readily understand that, the rates not being fixed by us, we are powerless to make any alteration in them.

Yours faithfully,

KENNETH MAC IVER, *Secretary*.

Manchester, *October 25th*, 1882.

NOTES.

Notice to Readers.—Subscribers are hereby notified that in future the supply of back numbers of the Electrical Review cannot be guaranteed by the publisher; it is therefore expedient that those who desire to complete their sets should do so at the first convenient opportunity. The publisher also desires to give notice that after December next all copies dated six or more months previously will be supplied only at enhanced prices, that is to say, 4d. numbers will be charged 6d., and others at similarly advanced rates.

The Use of Lead in Accumulators.—At the meeting of the United Van Consols Lead Mining Company, on Tuesday last, allusion was made to the demand for lead by electric companies for their accumulators and other apparatus as being likely to tend towards raising the price of lead ore from £9 to its normal price of £14 per ton.

Observations on Earth Currents.—By Dr. O. Frölich.—At the request of the Committee on Earth Currents appointed by the Electro-technical Association, the firm of Siemens and Halske have modified their so-called "soot-writer" (Russ-schreiber), so as to register earth currents continually. For a trial of this apparatus one of the wires from Berlin to Dresden was placed for a time at the disposal of the committee, and some interesting results were obtained.

The apparatus consists essentially of a current-disc moving in a constant magnetic field. Its movements are registered by a pointer upon a slip of paper blackened over with soot and drawn slowly forward by clock-work. The zero line is indicated constantly by a separate index. The ordinates of the curves drawn upon the paper are proportional to the currents prevailing at the time. The movement of the paper is regular and amounts to 117 millimetres hourly. The wire was sunk in the earth at Dresden and was connected with the earth at Berlin by means of the soot-writer. A Daniell element introduced into the circuit, gave a deviation of about five millimetres at the soot-writer. The author figures the curves obtained on the evening of July 22nd from 7.30 to 9.30 p.m., and on July 25th from 5.45 to 7.45. On the first occasion the weather was sultry, with some rain; on the second there was a strong thunderstorm with frequent flashes of lightning. On both occasions the current-curve showed a tolerably uniform course, accompanied by sudden convulsive deviations. If we neglect these, we find in the curves prolonged periods in which the index made continually a track of a certain width in the soot, being in constant movement. This is evidently due to the induction-strokes produced by telegraphing in the neighbouring wires of the cable. These inductions, especially if the Hughes' apparatus is employed, are of equal strength and compensate each other, so that the course of the curve is not disturbed and the middle of the broad track represents the value of the real earth-current.

Of the sudden deviations in periods when no despatches are being sent, some, though but few, are due to telegraphic attention signals. No regular periods of the earth-current could be recognised in the curves obtained either on these days or on others. The curve obtained during the thunder-

storm is of especial interest. The course of the curve of the earth current did not differ essentially from that obtained on the former occasions. Very conspicuous are the numerous and in part very powerful induction strokes in which the course of the storm may be traced. These induction strokes coincide with atmospheric discharges, for in a number of cases where the time was noted, the official watching the apparatus observed lightning simultaneously. The deviations in the curve of July 22nd may be due to fainter or more remote atmospheric discharges.

The chief result of these observations seems to be that during a thunderstorm the character and the strength of the earth-current are not essentially changed, and that the whole influence of the storm is expressed in induction strokes, which are due to atmospheric discharges.—*Electrotechnisch Zeitschrift.*

The Behaviour of Sulphate of Lead in a Secondary Battery.—Professor O. Lodge communicates the following information to our contemporary *Nature*:—"Since the meeting of the British Association at Southampton I have made several experiments on the action of sulphate of lead at the negative pole of a decomposition cell, with a view to ascertain, not whether the sulphate was reduced in bulk by the action of the nascent hydrogen, a matter concerning which I had satisfied myself before in the negative, but the less practically important matter whether any *trace* of metallic lead could be obtained upon the negative plate by this action.

"I used, therefore, platinum electrodes, immersing them in a paste of sulphate of lead in dilute sulphuric acid. And at the suggestion of Prof. McLeod, in order to obtain sulphate pure and in a fine state of subdivision, I precipitated a quantity from dissolved carbonate.

"The paste soon settled down, leaving about a quarter of an inch of clear liquid above it, which was decanted off. Small thick platinum plates stood in the paste about two inches apart, and were connected with either three or two Leclanché cells. When three cells were used, the evolution of gas from both plates speedily scooped out a hole round each filled with only turbid liquid, which was kept agitated by the bubbles.

"Under these circumstances a distinct darkening of both plates occurred, and after a day or two they showed a distinct, though extremely thin, coating of peroxide and of metallic lead respectively. Prof. McLeod had tried the same kind of experiment, and noticed that the darkening occurred more readily on portions of the plate in contact only with free liquid than on those imbedded in paste.

"I therefore re-embedded my plates, and employed only two cells to charge them, so that the bubbles might not have power enough to remove the paste from contact with the plates at all parts; under these circumstances the growth of peroxide of lead at the + plate was abundant, so much so that when the plate was ultimately pulled out, it left a black mass behind it, which had penetrated into the white paste; but the growth of the metallic lead on the — plate was even less perceptible than before, and it was evident that the metallic lead was better deposited from the solution than from the paste. It seemed probable, therefore, that though the sulphate is extremely insoluble in dilute acid, yet that a sufficient trace was dissolved to be acted on by the hydrogen, and that as fast as this was decomposed more was dissolved from the large quantity of solid present, provided the liquid was free to circulate and become replenished.

"To test this further, I first made a saturated solution of sulphate of lead in the acid, by shaking and stirring it up with the finely divided precipitate for many hours—though ordinary dilute sulphuric acid is probably perfectly saturated without any such treatment—and then electrolysed the clear solution. No effect is ordinarily perceived under these circumstances, and I could perceive none. Hence the quantity dissolved at one time must be something infinitesimal; and it is able to give no appreciable deposit, unless fresh solid is present to replenish it.

"Next I took a vessel full of the sulphate paste, but with a third of an inch clear liquid standing above it; and into this clear liquid I dipped the platinum plates, barely letting them touch the pasty mass below. In this position they remained several days connected to two Leclanchés, and the result was a distinct blackening of the — plate with a deposit of metallic lead from the solution; but the + plate scarcely seemed to receive any deposit of peroxide except along its bottom edge, which probably just touched the paste, and which showed a narrow line of deep puce colour. The observation that the — plate received its deposit more easily from the free solution than from the paste, had been previously made by Prof. McLeod. But to get the deposit most quickly, it is best to immerse the plates in the paste, and to cause sufficient gas to be evolved to keep them free from actual contact with it; while at the same time the solution surrounding them is so near a large surface of paste, that it can be very rapidly replenished.

"On neutralising the acid with ammonia, so that ammoniacal salts and common salt might be present, in which sulphate of lead is known to be somewhat soluble, the deposit of metallic lead went on with far greater rapidity.

"I have subsequently repeated the experiments with a paste of ordinary sulphate of lead, and the results appear to be quite the same. A week's deposit could be dissolved off the negative platinum plate with a single drop of nitric acid, and could only be made to show a faint precipitate when sulphuric acid was added to this solution in a watch-glass.

"Moreover, unless the plate were rinsed on extracting it from the paste, the small amount of sulphuric acid clinging to it was sufficient to so whiten the deposit in the course of a night as to make it seem almost as if it had disappeared.

"The matter is rather a small one to write so much about, but the behaviour of sulphate of lead in secondary batteries is really of considerable importance, and is at the bottom of a great many of the difficulties which one meets with in practical operations with secondary lead cells.

"Moreover, it is only due to Dr. Gladstone that I should say how far I have been able to obtain his results; and he will perceive that if all he asserts is that platinum electrodes do show a nearly infinitesimal tarnish of metallic lead (as I understood him to say at Southampton), then my experience agrees with his. But I think that this is merely due to the partial solubility of the sulphate; and I never find that the reduction is able to spread through the paste in the slightest degree, in such a way as to have any practical bearing on the behaviour of a secondary battery."

Gas v. Electricity.—Brampton is again lit with gas, says the *Derbyshire Courier*, and judging from the report of the proceedings of the Local Board, published in your columns last week, the members think they have made a splendid bargain with the gas company. The terms are to light the 50 lamps in the district from half an hour after sunset to midnight for six months for the sum of £100. The lamps are not be lit on moonlight nights, and the hours so saved are to be put on after twelve o'clock on very dark nights. Some time ago when the board asked the company to make an arrangement of this kind it was haughtily refused, and I only mention it now as indicating some little improvement in the disposition of the directors to meet the wants of their customers. But the terms! In the six months the lamps will be lit 1,200 hours, and the cost for 50 lamps will be £100. In Chesterfield the lamps were lit nearly 4,000 hours, and the cost for 200 lamps was £930. In other words, Brampton is paying *at the rate of* between £1,300 and £1,400 for what Chesterfield got for £930! It has been said that the tenders of the Electric Lighting Company were unsuccessful both at Newbold and Brampton, "mainly on account of the price." This is totally incorrect.

The tender at Newbold was exactly the same as that of the Gas Company, viz., £200 for 63 lamps for six months—the period asked for; but the Gas Company offered to light an additional month for an extra £10. Probably the Electric Lighting Company would have done the same, but it does not appear that they were asked. With regard to Brampton the error is still more flagrant, for there the Electric Lighting Company agreed to light the 50 lamps *all night* for six months for £100, the sum that is being paid to the Gas Company for lighting them up to *midnight!* Our friend Mr. C. E. Jones has placed on record his opinion that a gas-lamp is as good as a policeman; consequently at Brampton there will be just 50 "policemen" deficient after twelve o'clock, which is generally understood to be the time

when "the enterprising burglar" does his "burgling!" Why did he not persuade the Local Board to have the lamps lit the whole night? But in that case how would the cost have compared with that of the electric light?

The Electric Light on Ships.—The Admiralty have decided to light the troop ship *Himalaya* throughout with the electric light. The lamps to be used are the Swan incandescent. The dynamo machines are of the Siemens type, driven by the Brotherhood engines.

Electric Lighting.—A special meeting of the Dundas Gas Commissioners was held last week for the purpose of considering the advisability of applying for a Provisional Order to supply electric light to the town. A report by the gas manager on the subject was read. It stated that the works necessary for supplying the electric light to the town would consist of two centres of supply—one at the gas works and one in Ward Road. The size of the engines required would, of course, depend upon the demand for the light. A very convenient form, the dynamo machine, might be had, which would supply 40 arc lights, and to drive this machine would need an engine of from 40 to 50 horse-power nominal. This, to begin with, would be sufficiently extensive. He considered that a fair maximum price would be 1s. per hour for the arc light, and 4d. per hour for the incandescent lights. For the safety of consumers and the public, he recommended that all wires in the principal streets should be laid underground and encased in tubes. The commissioners, after full consideration of the matter, unanimously resolved to apply to the Board of Trade for a Provisional Order to supply electric light to the town.

A local contemporary says:—"It seems that there is an immediate prospect of the manufacture of electric lighting apparatus taking practical shape in Glasgow. The great drawback to its general use hitherto has been the expense of the necessary appliances and the motive-power, but if electric generators, motors, and lamps can be manufactured as cheaply and expeditiously as the Universal Electric Company undertake to do, there can be little doubt that for public works and street lighting at least, the electric light will become pretty general."

The Hamilton Town Council, at a special meeting on Thursday week, adopted the recommendation of their committee, "That application be made by the burgh for a Provisional Order as being the best policy in the present circumstances."

The Glasgow Corporation have decided to apply for powers to supply electric light for public and private purposes within their burgh.

The *Dundee Advertiser*, of Saturday last, says:—"Favourable opinions were expressed by the large number of visitors to the exhibition regarding the purity and coolness of the air in the galleries. The preservation of the purity of the colours of the pictures, as well as the purity of the air, is also a noticeable improvement due to the electric light, and was specially observed in deliciously warm colouring in the fine work by Phil. Morris, A.R.A., 'The Gipsy,' recently presented to the town by Mr. Orchar."

In the "Third Notice" of the works exhibited, the reviewer in the same paper, says:—"Those stolid conservatives, who feel it to be their chief end and mission to oppose everything which savours of innovation, have been loud in their prophecies of the failure of electric illumination. Especially was their contempt vented upon the deluded enthusiasts who dreamed of utilising the new light in picture galleries; and it was confidently asserted that the perfect colour transformations which the light from common gas caused would be greatly multiplied with the increased brilliancy of the electric light. But one evening visit to the Exhibition in the Albert Institute will be sufficient to dispel this illusion. It will be found that the delicate greens and blues, whose so altered appearances under gas-light horrified the very artists themselves, retain their pristine effect under the mildly diffused electric light; it adds to their intensity, without depreciating their value. Especially is this noticeable in the Second, Third, and Fourth Galleries, where the ordinary daylight is so defective that many of the pictures can only be properly seen by the aid of this artificial illumination. These are points which artists will most readily appreciate, while the ordinary visitor will not be ungrateful when he finds that he can have better light than gas can afford, without losing the oxygen which nature intended for him, and which the gas consumes to his discomfort."

At the meeting of the Glasgow Corporation, on Monday last, the clerk read a letter from the Brush Electric Light and Power Company of Scotland, offering to place a number of their arc lamps in any thoroughfare the Council may decide on, so as to show what their system is capable of doing, on being paid the cost of gas consumed in the locality in which they are installed. The letter was remitted to a committee for report.

The Watching and Lighting Committee's recommendation that the application from the Universal Electric Company, for permission to fix an electric arc lamp on the top of the clock, on the "Shetter," at Bridgeton Cross, the company fitting up and lighting the same free of charge, was agreed to.

In the neighbourhood of the Thuringian town of Kosen there are some disused saltworks, with considerable water-power. The latter is now to be utilised for the electric lighting of the town, and Kosen will thus be the first German town to introduce the electric light for illuminating the whole town.

Mr. Duncan and Mr. Hardy, both of Union Street, Aberdeen, have been trying the electric light for the illumination of their shops. The experiments have been most satisfactory, and these gentlemen have determined to replace the gas by the electric light.

The following alterations have been made in the rules issued by the Board of Trade in August last:—Rule 5, the words "The lands which the applicants propose to take for the purposes of licence or order" have been omitted. Rule 9, the wording of the first few lines of this rule has been altered to make the meaning more clear.

The City of London Commissioners of Sewers have decided to become the undertakers for the supply of electricity, and to apply to the Board of Trade for licence accordingly.

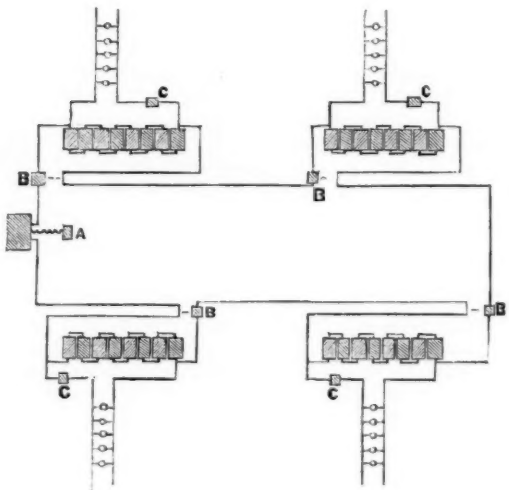
We understand that Mr. Conrad Cooke, whom we mentioned last week in connection with the Sheffield electric lighting, now holds a similar position in regard to Reading.

Electric Light Companies.—Under this heading the *Financier* writes:—"It is a pity, in the interests of the shareholders and of the public generally, that the various electric light companies should apparently be drifting into litigation, as the effect can only be that their progress will be paralysed and the shareholders' money wasted. Surely some arrangements could be come to for the good of all without so much rushing into print, and so much mutual defiance of presumed antagonists and infringers. The effect of the warfare is simply that the public are prevented from adopting as readily as they otherwise would do this really useful and beautiful light. That there is plenty of room for all is one of the most patent facts. Why then so much quarrelling?"

Electrical Education.—We hear that the demand for tickets by students wishing to work in the electrical laboratory, under Professor Ayrton, at the City and Guilds of London College, has now become so great that until the larger rooms at the new Finsbury College are ready, it has become a question whether any more tickets can be sold, since the 300 students now attending the electrical courses are even more than the present laboratories will accommodate. It is gratifying to find that this opportunity, offered by our city companies to workmen to obtain sound, cheap, technical education, has been so largely taken advantage of. Men in the employ of every metropolitan electric lighting company may be found among the students at the Finsbury College, and in some cases the students come regularly a distance of thirty miles, being employed during the day in the country. Some of the employers have shown the value they attach to their men being technically educated by paying themselves the college fees.

Electric Tricycles.—Last week the passers by were astonished at seeing a tricycle electrically lighted and electrically propelled going down Queen Victoria Street. The source of the electric current was a few Faure's accumulators resting on the footboard, the electric lamps, of which there was one on each side of the tricycle, were incandescent lamps, giving each about four candles, and the electro-motor was one of those recently devised by Profs. Ayrton and Perry, and was fastened under the seat which was occupied by one of the inventors. One speciality of these motors is their compactness and the large amount of power they can furnish for their weight, the total weight of the quarter-horse-power-motors, with the Faure's accumulators necessary to propel the tricycle with its rider at the ordinary speed, as well as to electrically light it, being only, we understand, about 1½ cwt., or but little more than that of a second rider.

The "B. T. K." System of Electric Distribution.—We have been presented with a copy of the circular issued to the shareholders of the South Eastern and Provincial (Brush) Electric Light and Power Companies, Limited, and also a block plan and general description of the mode of the "B. T. K." system of electric distribution invented and perfected by the electricians to these companies. It has not been patented, as they considered that the electric light in general should not be hampered by such means. Referring to the block plan, A shows the position of the



automatic regulating apparatus so constructed as to keep the current of electricity constant whilst being used for charging the accumulators, which may be situated any distance from the dynamo up to 35 miles; and should the dynamo be used for running the lamps direct from the machine, this regulator keeps the electromotive force constant, thereby keeping all the lamps at the same brilliancy independently of the number of lamps burning. This apparatus enables engines to be utilised that could not be employed under any other system, as it counteracts the effects of variations in their speed. By a peculiar automatic apparatus situated at B, only the proper quantity of current is allowed to enter the accumulator to supply the amount used since the previous charge; this apparatus is also a meter for registering the quantity of current supplied.

At C is an automatic contrivance for keeping the electromotive force constant whatever number of lamps may be turned on or off inside the dwelling-house in which the accumulator may be fixed.

It will be noticed that the system is that of charging the accumulators *in series*, and it will be understood from the previous description that as any accumulator becomes charged the apparatus B cuts this accumulator out of the series until some of the current has been used, when it brings the accumulator into the circuit again. It will also be seen from the diagram that the lamps are worked direct from the accumulators in multiple arc, and the apparatus, C, keeps the electromotive force of current passing to the lamps constant, through proportioning the resistance of the external to that of the internal resistance of the accumulator. These are the principal points of the system, but it also comprises many other minor apparatus.

International Protection to Ocean Cables.—"To the Editor of the *Evening Post*:—Sir,—I beg to enclose you an extract from the London *Times*, published in the New York papers of this morning, suggesting that the United States Government must protect submarine cables by international treaties as follows:—

"The *Times* this morning, in an editorial expressing satisfaction at the completion of telegraphic communication between the United States and South America, refers to the question of defending cables and says, 'the United States cannot too soon acknowledge the necessity for shielding submarine telegraph lines by international sanctions, and must find means for applying them.'

"This is a question that has failed to secure any definite action on the part of foreign Governments up to this time.

"I enclose herewith a recent correspondence with the Navy Department of the United States Government on this subject. Also the instructions of the Hon. Wm. H. Hunt, Secretary of the Navy, to Rear-Admiral George B. Balch, commanding United States naval force, Pacific Station, and a further correspondence between the Hon. Wm. Henry Trescott and his Excellency Senor Balmaceda, Minister of Foreign Affairs, Republic of Chili. You will observe that the spirit of this correspondence clearly indicates that submarine cables in the free seas, the property of American citizens, will receive the same protection as our national flag on the high seas.

"I will here add that the contracts between the various Governments, on whose shores the cables of this company are laid, secure to this company the international protection deemed so necessary by the London *Times*, and which up to the present time most other foreign cables have failed to secure. Respectfully,

"JAMES A. SCRYMSER,
President Central and South American
"New York, Telegraph Company.
"*October* 11th, 1882."

[The correspondence referred to by Mr. Scrymser appears to sustain the view which he takes—viz., that our Government will protect the cable on the high seas adjacent to the South American coast against interference, and that the Government of Chili, now administering the affairs of Peru, will consent thereto.—Ed. *Evening Post*.]

Western Union Telegraph Company's Election.—At a meeting of the Western Union Telegraph Company, to-day, at which more than 650,000 shares were voted upon, the following Board of Directors was elected:—Norvin Green, Thomas T. Eckert, Edwin D. Morgan, John Van Horne, Augustus Schell, Harrison Durkee, Jay Gould, Russell Sage, Alonzo B. Cornell, Sidney Dillon, Cyrus W. Field, John Pender, M.P., Henry Weaver, Percy R. Pyne, Robert Lenox Kennedy, Hugh J. Jewett, J. Pierpont Morgan, Frederick L. Ames, Edwin D. Worcester, William D. Bishop, C. P. Huntington, George B. Roberts, Zalmon G. Simmons, Samuel Sloan, Erastus Wiman, Amasa Stone, George J. Gould, Chauncey M. Depew, James W. Clendenin, George T. Baker.

The new directors will meet to-morrow and elect officers. The annual report was submitted, and shows that the capital stock of the company is 80,000,000 dols., of which 20,172·50 dols. belongs to and is in the treasury of the company. A small portion of the capital stock is still represented by certificates of indebtedness in the hands of the Union Trust Company, in trust for the parties entitled thereto. The bonded debt at the close of the year was as follows:—

	Dollars.
Bonds due March 1, 1900—6 per cent.	941,382·00
Bonds due March 1, 1900—7 per cent.	3,920,000·00
Bonds due March 1, 1902—7 per cent.	1,373,000·00
	6,234,382·00
Less balance of sinking funds appropriations not yet used for redemption of bonds, held by the Union Trust Company trustees ...	225,191·24
Total	6,009,190·76

Two thousand pounds in sterling bonds, due March 1st,

1900, were redeemed by the trustees of the sinking fund, July 1, 1881, showing a surplus of 127,258·76 dols. Profits increased it to 7,118,070 dols., from which there was applied for dividends, interest on bonds, and sinking fund appropriation, 5,265,662·73 dols., leaving a balance of 1,979,666·03 dols. represented in surplus of net revenue over dividends, interest, and sinking fund appropriations. For new property there was appropriated during the first quarter of the year 315,425·90 dols. Dating from January 1, 1882, the company has entered into contracts with the Gold and Stock Telegraph Company, and with the International Ocean Telegraph Company, to manage and operate the lines, property, and business of those companies for a term of ninety-nine years, guaranteeing to the stockholders quarterly dividends at the rate of six per cent. per annum, and being entitled to all revenues.

The statistics show :—In 1882, 131,060 miles of poles, 374,368 miles of wire, 12,068 offices, 38,842,247 messages sent, 17,114,165·92 dols. received, 9,996,095·92 dols. expended, leaving profit of 7,118,070 dols.—New York *Evening Post*, *23rd October*.

Cables Repaired.—The cable between Fao and Bushire is repaired. The cable between St. Lucia and Martinique is repaired, and telegraphic communication with all places in the West Indies established.

A Bankrupt Telegraph Engineer. — Alexander Maclean, telegraph engineer, was examined in bankruptcy on Monday, in Edinburgh Bankruptcy Court. The sederunt consisted of Mr. George Watson, C.A., trustee ; Mr. John Blair, W.S., agent in the sequestration and for the United Telephone Company, and Mr. Kelly, of Messrs. Boyd, M'Donald, and Jamieson, W.S., for the bankrupt. Examined by Mr. Watson, bankrupt stated that he commenced business about three years ago, after previous sequestration as an electrical engineer. He had no capital, and got assistance to the extent of about £150 from friends. He was never able to repay that sum. He attributed his non-success in business to having charged too low prices and to the disputes he got into with telephone patentees. He first found himself in difficulties when an action was raised against him by the United Telephone Company. If he had succeeded in the litigation, he had hopes that he would have retrieved himself. His liabilities, as appeared from his state of affairs, amounted to £1,725, and his assets, after deducting preferable claims, to £18. He became acquainted with the firm of Messrs. Harrison, Cox-Walker and Co. about a year ago, and had had several transactions with them. In June last he went to London principally to see the Electrical Exhibition. At that time he was not being greatly pressed by his creditors. While in London he met Mr. Walker, and ordered 1,000 transmitters. His reason for ordering the transmitters was that the United Telephone Company were applying for a disclaimer, and he wished his order given before they got their patent again. The transmitters had never been delivered to him. After further examination, the statutory oath was administered.

The Storms.—The *Scotsman*, commenting on the storm of Tuesday, says :—"With the occurrence of the first severe storm of the season, the inevitable result has happened —the telegraphic system of England has been completely disorganised, leading to much inconvenience and loss in the transaction of business throughout the country. With each succeeding year such a breakdown under the existing circumstances is rendered more and more certain. The trunk aerial lines are so much overweighted that they are unable to withstand such a strain as that of yesterday, and they are wrecked in all directions. The inconvenience was, in the case of newspapers, greatly increased yesterday by the fact that Parliament had just re-opened, thus necessitating a greatly increased telegraphic service. Our special reports have had, in consequence, to be considerably curtailed. A remedy for these constantly recurring interruptions of one of the chief services in the country is urgently called for. It has been provided in Germany, where a network of subterranean lines, placed beyond the reach of every storm, has been in successful operation for a considerable time ; and an even more perfect system is being introduced in France. Could not something in the same direction be done at home ?"

On the Galvanic Conductivity of the Non-metallic Bodies.—By M. Slouguinoff.—The feeble conductivity of the non-metals as compared with the metals seems to depend on a more complicated structure of the molecule. As the temperature rises the molecule grows more simple and the conductivity increases. Diamond is a non-conductor, because, according to Mendelejeff, its molecule is more complicated than that of graphite and charcoal. The molecule of conductive red phosphorus is simpler than that of the non-conductive yellow variety, as is confirmed by certain chemical considerations. Certain non-metals conduct in the gaseous condition, which is to be explained in the same manner.—*Wiedemann's Beiblätter*.

NEW COMPANY REGISTERED.

French Electrical Power Storage Company (Limited).—Capital £1,075,000, divided into 75,000 ordinary shares of £1 each and 100,000 preferred shares of £10 each. Objects: To acquire English or foreign inventions connected with electricity and electromotive force, or other similar agency. Signatories (with one share each): —Simon Philippart, 446, Strand ; H. P. Girlain, 13, Percy Street, Bedford Square ; W. Bradley, Surbiton ; E. J. Dowlen, 107, Isledon Road, N.; A. Golden, 27, St. George's Road, Regent's Park ; F. A. Pincoffs, 5, Warnford Court ; J. Burton, 25, Maddox Street, W. Directing qualification, shares to the nominal value of £500 ; remuneration, £3,000 per annum. Registered 21st inst., by Campbell, Reeves, and Hooper, 17, Warwick Street, Regent Street.

OFFICIAL RETURNS OF ELECTRIC COMPANIES.

The following returns have been recently filed :—

Anglo-General Electric Light Company (Limited). —At an extraordinary general meeting of the above company, held on August 14th, it was resolved to transfer the goodwill, &c., to the Laing Electric Light and Power Company, in consideration of £75,000 in fully paid shares of that company. The last return of the Anglo-General was filed on March 28th. The nominal capital is £24,000, in £1 shares. 15,000 shares have been allotted, and sixpence per share paid up, the total calls paid amounting to £375.

Buenos Ayres Electric Light Company (Limited).— The return of this company, made up to March 8th, was filed on May 6th. The nominal capital is £100,000, divided into 9,986 shares of £10 each, and 70 founders' shares of £1 each, the latter shares being all at present issued.

Consolidated Telephone Construction and Maintenance Company (Limited).—The annual return of this company, made up to May 8th, was filed July 27th. The nominal capital is £300,000, in £1 shares. The number of shares allotted is 145,165 ordinary and 45,835 vendors'; upon the former £1 per share has been called, the latter being considered as fully paid. The calls paid amount to £154,165.

Croydon Electric Light Company (Limited).—The return of this company, made up to August 24th, was filed on August 25th. The nominal capital is £5,000, in £1 shares. 590 shares have been taken up, and 5s. per share called thereon. The calls paid amount to £95 and unpaid to £52 10s.

National Telephone Company (Limited).—The second annual return of this company, made up to the 1st ult., was filed 9th ult. The nominal capital is £600,000, in 15,000 preference shares of £10 each, and 90,000 ordinary shares of £5 each. The number of shares taken up is 105,000. Upon the preference shares £6 has been called, and the full amount upon each ordinary share. The calls paid amount to £539,618 and unpaid to £11,502.

Siemens Brothers and Company (Limited).—The return of this company, made up to May 15th, was filed on May 25th. The nominal capital is £400,000, in 4,000 shares of £100 each, the whole of which are allotted. A call of £75 has been made, the calls paid amounting to £300,000.

Midland Electric Light and Power Company (Limited).—The return of this company, made up to April 20th, 1882, was filed on May 11th. The nominal capital is £50,000, in £10 shares, but the only shares at present issued are those taken by the original subscribers.

NEW PATENTS—1882.

4976. "Improvements in ship's binnacles and compasses, whereby the compass is made to indicate the ship's course as corrected for leeway." R. E. Melsheimer. Dated October 19.

4988. "Construction of electric arc lamps." A. Serraillier. Dated October 19.

4991. "Improvements in secondary batteries, and in the manufacture of the same." J. E. Liardet and T. Donnithorne. Dated October 19.

5001. "Telephonic instruments." G. L. Anders. Dated October 20.

5002. "Fittings for incandescent electric lamps." M. Evans. Dated October 20.

5014. "Improved means of regulating electric currents, and electromotive force and apparatus therefor." L. Campbell. Dated October 21.

5015. "Electro-magnetic and magneto-electric engines." C. F. Varley. Dated October 21.

5016. "Electro-magnetic and magneto-electric engines." C. F. Varley. Dated October 21.

5017. "Electro-magnetic and magneto-electric engines." C. F. Varley. Dated October 21.

5019. "Iron and steel tubular telegraph poles, and manufacture of certain kinds of iron and steel tubes for telegraph poles, and for other purposes." J. C. Johnson and R. Martin. Dated October 21.

5023. "Carbons for incandescent electric lamps." M. Bailey. Dated October 21.

5035. "Lightning conductors." H. G. Haddan. (Communicated by J. Kernaul.) Dated October 21.

5050. "Improvements in and relating to electric lighting apparatus, which improvements are partly applicable for other purposes." H. H. Lake. (Communicated by S. F. Van Choate.) Dated October 23.

5055. "Generating and storing electricity and appliances connected therewith." F. H. Varley. Dated October 24.

5059. "Application of electricity to rotatory hair-brushes." N. J. Holmes. Dated October 24.

5060. "Machines and apparatus employed in the production, collection, and utilisation of electric or magnetic currents or forces." J. S. Fairfax. Dated October 24.

5078. "Improvements in secondary batteries, also applicable to ordinary galvanic batteries." A. F. Hill. Dated October 24.

5092. "Electric generators." E. Jones. Dated October 25.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

1882.

1085. "Electro-magnets and armatures therefor." W. P. Thompson. (A communication from abroad by Gerritt Smith, of America.) Dated March 7. 8d. The object of this invention is to attain a greater degree of rapidity of vibration in the armatures of electro-magnets, such as are employed in telegraphic receiving instruments and other like mechanism, than has been possible with apparatus of this kind constructed in the usual manner. The invention is principally useful in connection with telegraphic apparatus, particularly in cases where unusual rapidity of signalling is necessary, as in Wheatstone's and other automatic systems. The invention consists in actuating the armature of the electro-magnet and its necessary mechanical attachments through the instrumentality of a constant mechanical power whose action is controlled by electro-magnetism, in lieu of causing the armature and its attachments to be actuated solely by the direct attractive force of the electro-magnet as heretofore. The inventor makes use of a cylinder or disc of magnetic metal, such as iron or steel, which is so mounted as to rotate upon an axis within a magnetising helix. An armature of iron or steel is maintained in permanent magnetic contact with the surface of said cylinder, and is so mounted as to be capable of receiving motion therefrom by friction. In some cases the inventor provides a spring or other retractor, which tends to exert a constant force upon said armature in a direction opposed to that which it derives from its frictional contact with the moving cylinder. Fixed stops, which are preferably made adjustable, are provided for the purpose of limiting the movement of the armature in each direction. The magnetising helix which surrounds the cylinder is included in an electric, or telegraphic circuit, and a suitable key or transmitter may be placed at some point in said circuit, which acts to alternately increase and decrease the strength of current traversing said circuit. Fig. 1 is a plan view of an apparatus illustrating one method of carrying out the invention, in which a part of the apparatus is broken away to exhibit the internal construction; and fig. 2 is a transverse vertical section, taken in the plane of the dotted line, 2, 2, in fig. 1. Referring to figs. 1 and 2, A represents a suitable base upon which the various parts of the apparatus are mounted; B is a helix or coil of thin insulated wire, which is wound upon a hollow bobbin, *b*, the lower flange of b^1 of which should be formed of ebonite or other insulating material. C is a cylinder of soft iron, fitting closely within the central opening of the hollow bobbin, *b*, but capable of rotating freely upon its longitudinal axis. The cylinder, C, forms the magnetic core of the helix, B. It preferably has an enlargement, or flange, *c* (fig. 2), formed upon its upper end. Upon the lower end of the cylinder, C, is fixed a small pulley, D, which revolves beneath the base, A. A belt or band, D^1, passes around the small pulley, D, and also around a larger pulley, E, which is also mounted in the same plane beneath the base, A, as shown in dotted lines in fig. 1. A crank, F, is affixed to that portion of the shaft, *e*, of the pulley, E, which projects above the base, A, by means of which crank it may be turned by the hand of the receiving operator in the direction indicated by the arrow. When the crank, F, is thus turned, the soft iron cylinder, C, constituting the core of the hollow helix, B, is caused to rotate rapidly in the direction indicated by the arrow in fig. 1. The

FIG. 1.

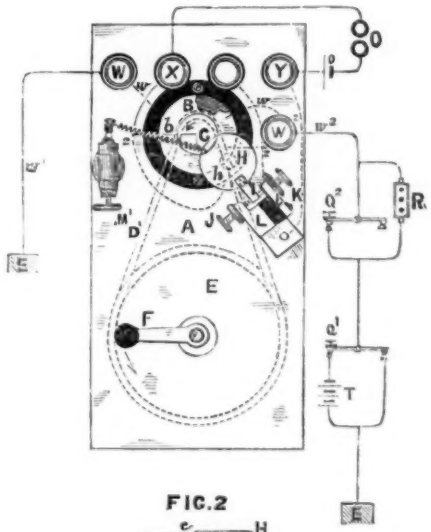
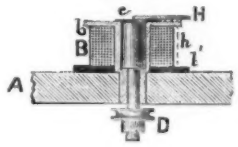


FIG. 2



upper surface of the soft iron cylinder, C, is polished, and is moreover carefully turned and fitted, so as to revolve as accurately as possible in a horizontal plane. H is an armature preferably formed of a thin flat disc of soft iron, a small portion of the periphery of which rests upon the upper surface of the cylinder, C, near the edge of the flange, as shown in figs. 1 and 2. The disc or armature, H, is capable of moving freely in a horizontal plane upon its vertical pivot or axis, *h*, but the extent of this horizontal motion is limited by a rigid arm or lever, I, affixed to the armature and moving with it, which plays between fixed stops, J and K. These stops may with advantage be rendered adjustable by mounting them upon screws, or other well-known equivalent devices, as shown in fig. 1. The stop, J, is mounted upon a standard, L, upon the base, A, and the stop, K, is mounted upon a bracket, *l*, secured to but insulated from the standard, L. The retractor, M, consists of a spiral spring attached to the armature, H, preferably at a point in its periphery diametrically opposite to the point of attachment of the arm, I. The retractor is capable of adjustment by means of the milled-head and spindle, M^1, or other suitable means, so as to exert a constant force of any required amount upon the armature, H. The helix, B, terminates in the projecting wires, *w*, *w*, which are electrically connected to the binding screws, W^1, W^2, and serve to form a connection with the main line. The apparatus thus constructed is placed at a receiving station in the circuit of a telegraph line, the connections being completed in the ordinary manner by means of a wire, w^1, connecting the terminal post, W^1, with the earth at the receiving station, while the line wire, w^2, coming from the transmitting station, is attached to the terminal post, W^2. The key at the transmitting station may either be arranged to open and close the circuit of the main battery, T, as shown at Q^1, or it may be inserted in the manner shown at Q^2, so that when closed it will shunt a constant resistance, R, normally interposed in the line, and thus act simply to alternately increase and decrease the strength of current in the line, without interrupting the circuit. The operation of the apparatus is as follows:—When a telegraphic communication is to be received upon the instrument, the cylinder, C, which forms the core of the coil, B, is caused to rotate upon its axis in the direction indicated by the arrows, which may be effected by turning the crank, F, as hereinbefore explained. So long as no electric current traverses the coil, B, the friction between the cylinder, C, and the armature, H, which rests lightly upon it, will be so small that the cylinder will have but a slight tendency to drag the armature along with it, and this tendency will be overcome by the resistance of the spring, M, so that the armature will remain in its normal position (shown in fig. 1), the arm, I, resting in contact with the rear stop, K. When, however, an electric current is transmitted through the line, as by the depression of the key, Q^1, the cylinder, C, instantly becomes magnetic by the inductive influence of the coil, B,

and attracts the armature, H, which rests upon its periphery. The pressure produced by this magnetic attraction increases the friction between the two surfaces to such an extent, that the antagonistic force of the retracting spring, M, is overcome, and the armature, H, is caused to turn upon its axis by the force imparted thereto by the friction of the rotating cylinder, C. Hence the arm, I, is brought into contact with the stop, J, in which position it remains so long as the electric current from the transmitting station continues to traverse the coil, B. When the current is interrupted by the raising of the key, Q^1, the attraction between the cylinder, C, and the armature, H, ceases, whereupon the recoil of the spring, M, instantly restores the armature, H, and its attached arm, I, to their normal position. In case it is desired to operate the apparatus by an alternate increase or decrease in the strength of a constant current, as for example, by manipulating the key, Q^2, the tension of the retracting spring, M, is so adjusted that the friction due to the magnetism induced by the normal or minimum strength of current is not quite sufficient to overcome its tension, but any increase of friction beyond the normal amount will overcome the spring, and instantly communicate a lateral movement to the armature, H, in the manner hereinbefore explained.

1142. "Regulating the generative capacity of dynamo or magneto-electric machines." T. J. Handford. (A communication from abroad by T. A. Edison, of America.) Dated March 9. 6d. The object of this invention is to provide simple and efficient means for regulating the generative capacity of dynamo or magneto-electric machines by acting upon the commutator brushes or springs to move them away from and towards the points of greatest difference in potential or most effective generation. This object is accomplished by a mechanism which is both actuated and controlled by the current generated. For this purpose is used a double or single motor, or motor-like mechanism, connected with the commutator brushes, so as to move them together in one or the other direction. The electric circuits to this mechanism supplied by the current generated are made and broken by an electro-magnet also energised by the current generated by the machine. In carrying out this invention, the arms carrying the commutator brushes are mounted on a yoke pivoted upon the journal box next to the commutator cylinder and around the armature shaft. The yoke also carries a worm wheel, with which engages a worm. Secured to this worm are two ratchet wheels with teeth raking in opposite directions. With these wheels engage two pawl bars carried by armature-levers. The lower ends of the armature levers engage with circuit makers and breakers which are pivoted, Y-shaped pieces playing between contact screws and making their forward contacts when the armature-levers are retracted, and their back contacts when such levers are drawn forward by their electro-magnets. An electro-magnet (the controlling device) is placed in a multiple arc circuit from the main conductors of the machine. A resistance is also placed in the same circuit. An adjustable shunt around more or less of this resistance, as desired, has one part connected with the Y-shaped circuit controllers and the other part with the armature-lever of this controlling magnet. The front and back contacts of this last armature-lever are connected with the coils of the two electro-magnets first mentioned, and from the other ends of these magnet coils connections are made with the front contacts of the Y-shaped circuit controllers. A spring arm is employed to determine the central position of the armature-lever of the controlling magnet. When there is the desired degree of generation to supply the translating devices in circuit, the controlling armature-lever stands in a central position, leaving the circuits to both of the vibrating mechanisms open; but a decrease or increase beyond fixed limits, caused by a change in the number of translating devices, or by other reasons, produces a movement of the armature-lever of the controlling magnet and a closure of one or the other circuit to the vibrating mechanisms. The mechanism in circuit operates continuously until the brushes are adjusted to the desired point, when its circuit is broken by the controlling magnet.

1172. "Incandescence electric lamps, &c." J. Wauthier. Dated March 10. 6d. Relates to improvements in incandescence electric lamps, and has for its object first to obtain a greater body of light in a small compass by making the carbon filament of peculiar form, so as to get a greater length of filament than usual. The invention has for its object secondly to lessen the number of joints in the conducting wires and to more effectually protect the said wires, and to avoid twice sealing the exhaustion tube and more effectually protect the same and reduce the labour and cost of manufacture.

CITY NOTES, REPORTS, MEETINGS, &c.

WEST COAST OF AMERICA TELEGRAPH COMPANY (LIMITED).

Under the presidency of Robinson Kendal, Esq., chairman of the board, the fifth ordinary general meeting of the shareholders of this company was held at Cannon Street Hotel on Monday.

The notice convening the meeting having been read by the secretary, Frederick L. Robinson,

The Chairman said: In rising to move the adoption of the report and to say a few words in regard to it, I may in the first instance say why it is issued at so comparatively late a period. You all know that a state of war and a state of semi, if not of actual, censorship exists on the coast, and that it is impossible in the present disorganised state of the postal and other arrangements of the country to count upon anything like regularity in the transmission of accounts and correspondence. As a matter of fact, it often happens that letters come to hand two or three mails behind time, other letters written weeks after arriving before them. This, I need not say, is a serious matter when some three months are taken to send out an inquiry and receive an answer by post; and hence it is that our accounts are issued so late in the year. Next year we hope we shall not only have a better and more promising balance-sheet, but we hope to issue it at an earlier date. As regards the report itself I may say, although it is not so favourable as the board could wish, it is yet as satisfactory as under all known circumstances we could reasonably expect it to be. Whilst reducing our expenditure we have increased our income by the sum of £15,000 for the year, and we have to show a net profit of £1,308, a result, as the report shows, which will probably be looked upon as satisfactory, regard being had to the continuance of this deplorable war, and considering that Lima, one of our terminal stations, was only open half the year; whilst Mollendo, another of the company's stations, was blockaded by the Chilian fleet during the whole year. We have increased our staff upon the coast this month by two clerks, and we are sending out two more clerks in anticipation of increased traffic and work. Notwithstanding this increase of our expenditure, I have reason to think that our expenditure as a whole will be less than at present, for there are some items in our expenditure, to which I need not now call attention, which will be reduced, and others which will disappear altogether. As it is, and as the report shows, we have this year paid all the interest on our debentures, as well as an item of £8,299 15s. 8d. outstanding, due by the company, and we have now a respectable balance at the bank. As regards the future of the company, and not to indulge in predictions and expectations, I think that without counting upon the possibility of peace being restored, we shall have a sensible addition to our present income, and that from our own work, to say nothing of our connection with the new and extensive lines touching the Pacific over 3,000 miles until they reach Mexico and the United States. We shall be able to show in our next report what the present report foreshadows, a considerable improvement in the position and prospects of the company. The guano contract was set for 1,000,000 tons during the past week, and the shipment must bring necessarily increased business to the coast; but as a matter of fact, and speaking broadly, it is not a guano contract that is wanted on the coast, but peace—peace between Chili, Peru, and Bolivia. At Taltal there was opened, recently, another of those small lines of railway, running inland from the coast; and from this, under anything like a settled state of things, something in the way of increased trade and commerce may be expected. But it is not to systems of steam locomotion or steam navigation we must look, but to the restoration of peace and the general re-establishment of something like credit, commerce, and industry. As a trading company—for we are neither more nor less—it is not our province to interfere with political questions; it is our business to be the friends of all, and offensive to none. Still it cannot be out of place to think it possible to bring the war to a happy issue. We all know the trading condition of Lima; it is summed up in this, the rate of exchange is 2½d. per dollar. What the rate of exchange is the state of trade is, and what the state of trade is we all know. We can, however, only hope for better days, and nothing would give me greater pleasure than to be able to announce to-day that peace had been concluded between Chili, Peru, and Bolivia. As regards the company's claim, I must ask you to leave that in the hands of the board. It involves questions of municipal and international law, as well as questions of right and justice; and this is not the place to discuss these. Of this you may rest assured, that the board will not cease to press their claim, which they believe to be fair and just, and unless the Chilian Government is to belie its high reputation for honesty and honour, it will not be pressed in vain. With these remarks, I beg to move the adoption of the report.

Mr. T. F. Campbell seconded the motion, which, on being put to the meeting, was carried unanimously.

Mr. T. F. Campbell then proposed the re-election of the retiring directors, Mr. R. Kendal (the Chairman) and Mr. Matthew Gray.

Mr. Scott seconded, and this proposition was also carried.

The Chairman briefly returned thanks, remarking that the shareholders worked very hard in the interests of the company. Nothing could be done which had not been done for the interests of the company in the circumstances in which the board had been placed.

Mr. Mason next proposed the re-election of the retiring auditor, Mr. J. Weise, of Turquand, Youngs and Co.

This was seconded by Captain Marshall, and Mr. Weise was re-elected.

Mr. Mason, in proposing a vote of thanks to the Board, remarked that he considered the accounts satisfactory, and he thought the company about the most carefully managed one of its kind. He hoped Mr. Kendal's anticipations might be realised.

In reply the Chairman said on the last occasion of their meeting there they had amongst them their old friend, Colonel Tilney, who has since died. He left a testamentary document that his shares in this company were not to be sold but to be kept for his family, a great proof of confidence in the company. He hoped the board would always have regard to the fact that they were trustees, and will endeavour to do the best for the shareholders.

The proceedings then terminated.

ELECTRIC SUN LAMP COMPANY.

The first statutory meeting of the above company was held in Cannon Street Hotel on Tuesday last, Sir James Carmichael presiding. The secretary, Mr Pennell, having read the notice convening the meeting, Sir James said: Gentlemen, my first duty is to apologise on behalf of our chairman for his unavoidable absence. You are all aware that this meeting is a formal meeting, what is called a statutory meeting convened under the act, and at such meeting no report or accounts are submitted to the shareholders. At the same time I think it would be satisfactory to you for me to state very briefly the present position of the company, and what it has been doing, and if any gentlemen present desires to ask me any questions, I shall be

happy to afford any further information in my power. You are aware that we have modified an agreement made with the inventors and patentees of the Sun lamp, the whole of our capital has not been subscribed, only to the extent of 7,663 shares, making in round numbers about £40,000. Under our original contract with the patentees and inventors we arranged to give them £50,000 in cash and £50,000 in shares. Of course on our only receiving the amount I have stated, that became impossible, and we immediately before allotting or taking any steps met the inventors to know what modified terms they would agree to. I am bound to say that they met us in a very liberal spirit, and agreed instead of a payment of £50,000 to take £40,000, and they went further, and said that out of the £40,000 they would be content to receive at the present moment £7,500 in cash for their patent rights, leaving the balance to be paid after we had issued further capital. The old agreement only remains in force till December next year, 1883, and if in that time the balance is not paid they are bound to take the whole balance in shares. That shows that the inventors have very great confidence in their invention, because beyond the £7,500 in cash the rest is liable to be paid entirely in shares. I may remark that the £7,500 they received included all the expenses of transferring the right to this company and all the expenses connected with the formation of the company. That showed the liberal spirit of the inventors, and I am bound to say that I do not think any company of the same nature as our own was ever started with a more liberal and fair arrangement with regard to the purchase of the patent rights. We have since then been doing our best to put things into shape and go to work, and I need not tell you that a new thing like this moves rather more slowly than we could wish. The first thing was to organise a staff, which I am happy to tell you has been done. Then we had to look about for suitable premises in London for workshops, &c., where we could set up our light and call the attention of customers to its great merits. We have succeeded in obtaining very eligible premises in a very suitable part in the west of London—Ridinghouse Street, just behind Langham Church, where we hope by the middle of next month to be able to ask you to come and see the light in full operation. So far, of course, we have not been in a position to take any large orders, because we, like everybody else in our position, have had to wait for the dynamo machines and all the necessary apparatus connected with electric lighting for which the demand has been so great. I may also mention, as another rather important reason against entering at once into contracts, that our engineer and inventor has been making improvements of a very satisfactory character, and pending the completion of these we do not like to put up lamps just to take down again. I think that we have now got a lamp very much better in various respects than the one which we originally had. As you are aware, we are entitled to every improvement made and invention connected with the lamp that the inventor may yet bring out. We have applied to two vestries for permission to lay down wires and to light the district round our own central premises. If we get the licence from the vestry we can light Regent Street from our central office, and we hope before long to be able to do so. I shall be happy to answer any questions which any gentleman may wish to ask. We now know our business is properly organised, and we hope before our next meeting to have contracts which we are not at present able to take.

A shareholder asked whether they could compete with the lights offered to the public by other companies, both for interior and street lighting.

The chairman said that their speciality lay in house lighting. He thought their lamp was more suited for lighting buildings, workshops, and shops of every description. Yet at the same time he had no reason to think that it could not be used for public lighting. It had never yet been tried as a street light. When he spoke of lighting Regent Street, he meant lighting up its shops.

In answer to another shareholder, the chairman said that they had now two lamps burning in the *Times* office.

The proceedings then terminated.

WEST INDIA AND PANAMA TELEGRAPH COMPANY (LIMITED).

The eleventh ordinary general meeting of the shareholders of the above company was held on Wednesday at the City Terminus Hotel, Cannon Street, C. W. Earle, Esq., chairman of the company, presiding. The Secretary having read the notice convening the meeting, the minutes of the previous meeting were read and approved. The Chairman said: Gentlemen, we have not to submit to you anything which is worthy of any very special remark at this meeting, and I shall, therefore, not take up your time with referring to them with any detail. I may, however, mention that so far as the current expenses are concerned these are decidedly less than at the corresponding half year. On the other hand, the traffic receipts are the best we have ever had. They are very poor when compared with other companies of like magnitude, miserably poor, yet it is satisfactory to find a little increase on the half year. Turning from the ordinary expenses of administration to the repairing expenses, we come upon a very disagreeable item indeed. The ordinary repairs I may say amount to much the same as we have been having of late years, but there is a very heavy expenditure upon the St. Thomas and St. Kitts' cable which has taken away your dividend, and is a very serious item in the year's expenditure. As to that cable, you may recollect that a year ago we laid in some 65 knots of new cable for use at the east end towards St. Kitts. At that part of the cable we had experience of frequent breaks, we had the idea the ground was very rocky, very bad, and unsuited to a cable. We therefore examined and sounded the bottom and founda better line a little to the north, and having done that and laid in, as I have told you, 65 knots of new cable we thought that as the west end had never troubled us much we should have a pretty secure communication. However in the beginning of this year a fault occurred at the west end. The ship went and grappled, and found the water excessively deep, the bottom very rocky, and with a very uneven surface, falling many hundred fathoms in a very short space—there being, in a mile, a difference of from five to 600 fathoms of water. That is, of course, very inimical to the life and durability of a cable. When the ship came to grapple for the cable, she found that it was so embedded in the 10 years that it had lain there that it was impossible to lift it, especially at the great depth at which the ship was working—1,700 fathoms. She grappled along the line for a considerable distance, being very much interrupted by bad weather, and having constantly to run to the Thames for shelter and for coals. Her operations were, therefore, much delayed in consequence; altogether she was seven months at the work, but at last we thought it best not to waste any more time on that section of the cable, although we were naturally anxious to save as much of it as we could, and therefore d d not like to abandon the hope of recovering prematurely. However, at last, we saw that there was nothing for it but to lay a new section, and so eventually we joined the cable at the expense of 106 knots, and a great expenditure in coals and other essentials. This item of repair, which I suppose will cost about £15,000, is a very heavy one to us, because our revenue is so poor. Other companies, of course, have had much larger expenditures upon repairs. Sir James Anderson and Mr. Weaver could tell you of an instance in which £90,000 has been expended (in another company) in repairing one single cable. Although the sum I have mentioned would be light to a prosperous company with a good revenue, it happens to be a very crushing blow to bear such expenses as these to us. The great point of interest in the report is the result of our mission to the West Indies, and the conference held at the Barbadoes. Before going into that, I must ask you to allow me to go back a little in our history. Soon after the present board was elected, in 1874, and we had got our system in thorough operation, we found out from two years of almost uninterrupted work at every station, that the traffic was very poor. Instead of £156,000, which was mentioned in the prospectus as being the probable traffic of this region, we really found that it was nearer the £56,000 than the £156,000. Having made this disagreeable discovery, it became our duty to consider what was best to be done. I remember being somewhat taken to task at a meeting here—I think by my friend Mr. Clifford for saying that the policy of the company was a policy of importunity. I think the experience of the company during the last six or seven years has shown us that no development is possible in the West Indies. The traffic is so very small; the colonies and communities there are small, and there is not traffic enough to support a system like this. Hence we have tried from time to time to obtain a revision of the contracts under which our company was formed. Our first effort was the despatch of Mr. Kingsford to obtain from the colonies permission to increase the rates; for I must tell you the rates were stipulated—made a condition in the Acts under which the company was constituted and the cables laid. We therefore sent to the colonies, and we succeeded in getting a revision of the tariff in our favour. This revision has produced a certain good effect; our traffic has been better than before, although the introduction at the same time—for we were obliged to concede something when we asked so much—of the word-rate, especially when eventually the codes of the merchants became more perfect, has very much diminished what otherwise would have been the increase of our revenue by our increased rates. After that increase of rates was granted and established we still found the revenue most unsatisfactory, and therefore we, two years ago, decided upon again appealing to the colonies for some further concessions and revision of the very onerous conditions under which we were established, and with which, I may tell you, the present board had nothing whatever to do. We obtained the services of Mr. Grosvenor, who went out for some five or six months to the West Indies and who visited all the colonies. He obtained no tangible result in accession of revenue, but from that visit he did obtain this: that a conference on the subject of telegraphic communications was consented to, and after having received the approval of the Secretary of State for the Colonies, a conference was appointed to be held at Barbadoes in the month of May of the present year. Mr. Grosvenor could not return, so we requested Mr. Kingsford, who had already visited the West Indies, to proceed, accompanied by the secretary, to be present at the meetings of this conference. The conference assembled; Mr. Kingsford made a very able speech, and they proceeded to business. But very soon it was apparent that it was not to inquire into our position or what we were able to do, or what we ought to do, or to consider the question of fair and liberal treatment towards us that the delegates had arrived there, but really to propound a scheme of their own, of which mention is made in this report. It is quite true that some of the smaller colonies were in favour—and one of the larger ones—of giving us what we asked, but two of the principal colonies were opposed to us; and it was so apparent that the minds of their representatives were so made up that they did not care for the feelings of the smaller colonies, and the result was the proposal and adoption of this scheme. The first resolution that introducing this scheme is to the effect as the justification of it that the West Indian Telegraph Company has failed to satisfy the requirements of the West Indian colonies. Before we attach very much value to that statement, I think it is only fair to ask whether the requirements were reasonable, and whether the company was put by its revenues in a position to satisfy those requirements. There are two requirements which it appears to me the West Indies insist upon; one is cheap rates. Well, the rates had been fixed by the colonies themselves (hear, hear). They certainly were high rates, but of course in a poor region like that, where the telegraph is very little used, you must have high rates. It is a rule that holds in every part of the world, where you get out of the beaten track of a large traffic—and it does not matter whether it is Hansom cabs or omnibuses—you must have high rates if you ply in a country where there is not much custom. The other requirement was a very extensive daily bulletin, which we were obliged to publish under our concessions, and that is a matter which has always given us very

great trouble and annoyance. We are pledged, as has often been said before, to publish a great quantity of the market prices of the materials in which the West Indian colonies deal, and we are pledged to publish the movements of the mail steamers, lists of passengers, and the general news of the world. Of course this is not only a very onerous and difficult duty for the telegraph company, which is not a news agency, but it eats into the legitimate sources of the revenue. It is very much the same thing as if you were to ask railway companies from the north to supply everybody in London with coals. It is really giving for nothing the material upon which we ought to live, and it is not only disadvantageous to us in that respect, but it also causes great discontent in the matter that those who are supplied with news are never satisfied. I can quite understand that in an outlying part of the country where you get up in the morning and call for a newspaper in which these bulletins are contained, that you might be inclined to grumble. Even in the *Times* here you often hear it said, "There is no news in the paper." The English colonists complained that we gave nothing but French news, and the French colonists complained that we gave nothing but English news, and so between the two we were in bad odour all round, where it was not our fault. These requirements are difficult to meet, and it does not seem to me that the conference took much trouble to inquire whether they were reasonable requirements or whether we could fulfil them. However, the scheme, as proposed, was carried unanimously by the delegates. I do not myself believe very much that this scheme will come to anything. I do not think that our Government is inclined to put down £350,000 in cables for the colonies; they have never done so yet, and I don't expect they will. I very much doubt that the smaller colonies, when they come to understand what is meant by this measure, will join in it. That those colonies, with a revenue of £30,000 a year, should have to stand the work of heavy repairs in the Atlantic I think will frighten them out of it. When you think that some of the cable repairs cost as much as £90,000 in one repair, I think probably that will rather make the colonies cool a little before going into such a business. As the matter stands now, Mr. Kingsford, our representative, has visited the different colonies, and so I am not without hopes that some good will come from his representations and interviews. I may tell you that I have seen this morning the Receiver-General of Trinidad, and he authorises me to say that the subsidy of that colony has been increased, and is in the estimates for the current year from £2,500 to £6,000, which will be regularly paid, unless this scheme should come to anything, on the line from Bermuda to Nova Scotia, which I don't believe. I think that is perhaps a sign of rather more liberal and just feeling towards us, and am not without hope that perhaps with some concessions on our part we may be able to get the colonies with us. I think nobody is likely to take our place in a losing concern like this. The Americans have laid a cable down on the West Coast of Mexico, touching Panama, and joining with the West Coast cable lines at Lima. I think that is all I have to tell you. We feel very much the unfortunate results of this enterprise, but we are convinced that it is entirely owing to the ground upon which we have to work, and that nothing further can be done except by alteration of the terms which were originally entered upon. I now beg to move that the directors' report and accounts to June 30th, 1882, submitted to this meeting, be and the same hereby are, received and adopted.

Mr. Ford seconded the motion.

Mr. Abbott said that doubtless the meeting was surprised at the extraordinary announcement which had been confirmed in the report. Instead of the West Indian colonies rendering the company any assistance, they had in contemplation a magnificent scheme to assist the colonists. If their plea was poverty, how was it that they could find £650,000 contingent on the English government finding them £350,000 to compete with capital already lying dormant (hear, hear)?

Mr. Bears thought they would have listened to Mr. Abbott's remarks with more attention if he had prefaced them by saying that he had gone to America in the interests of the shareholders of the West Indian and Panama Company (laughter).

Mr. Abbott, in moving a vote of thanks to the chairman, hoped that some arrangement might be come to whereby all their money would not be swallowed up in repairs. It was time some such plan was matured.

Mr. Robinson Kendall seconded the motion, which was carried by acclamation.

The Chairman briefly expressed his thanks, and the proceedings terminated.

THE INDO-EUROPEAN TELEGRAPH COMPANY (LIMITED) has given notice that an interim dividend for the half-year ending 30th June last at the rate of 5 per cent. per annum, free of income-tax, will be payable on and after the 1st November next, on all shares standing registered in the company's books on the 23rd day of October, 1882. Coupons held in this country must be deposited at the company's London bankers, Messrs. Barclay, Bevan, Tritton, Twells, and Co., No. 54, Lombard Street, E.C., three clear days before payment, for the purpose of verification.

THE DIRECT UNITED STATES CABLE COMPANY (LIMITED).—We are informed that the board has resolved upon the payment of an interim dividend of five shillings per share, being at the rate of five per cent. per annum for the quarter ended 30th September, 1882, such dividend to be payable on and after the 16th November next.

THE TELEGRAPH CONSTRUCTION AND MAINTENANCE COMPANY (LIMITED) announces a distribution at the rate of 1s. 2d. per £5 Second Bonus Trust Certificate on November 1st, and payable two clear days after presentation of coupon No. 15 at Messrs. Barclay, Bevan, and Co.'s Bank, 54, Lombard Street.

THE EASTERN EXTENSION TELEGRAPH COMPANY (LIMITED) notifies that the coupon due November 1st on their Five per Cent. Debentures will be paid at the Consolidated Bank, 52, Threadneedle Street. Coupons to be left three clear days for examination.

"BRUSH" ELECTRIC LIGHT AND POWER COMPANY OF SCOTLAND (LIMITED).—Mr. N. W. Levin has retired from the board of this company on account of his approaching visit to New Zealand.

SUBMARINE TELEGRAPH COMPANY.—Owing to the cables of this company being interrupted by the storm of Tuesday last, the receipt of telegrams from the Continent has been greatly interrupted.

AUTOMATIC TELEGRAPH.—Creditors must send in their claims on or before the 21st November to Mr. S. M. Richards, of 141, Fenchurch Street, E.C., the liquidator.

APPLICATIONS have been made to the Committee of the Stock Exchange for a special settling day in the shares of Edison's Indian and Colonial Electric Company (Limited), and for a quotation in the shares of the Gülcher Electric Light and Power Company (Limited).

A SPECIAL settling day has been granted the Anglo-Austrian Brush Electrical Company (Limited) shares, namely, Tuesday, 24th October, 1882.

QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid.	Closing Quotations. Oct. 25.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	4	10½-11	11⅛ ⅜ ⅝ m. 11⅛ 12 11¼ ⅜. 10⅝ ac.
		Do. Do.	10	21 - 25	22½ 4½ m.
30,000	5	Australasian Electric Light, Power & Storage Co.	3	1⅛ - 1⅜	
24,900	10	British Insulite Co., Limited, "A" Shares	5	4¾ - 5	
30,000	5	Brush Electric Light & Power Co. (Scotland)	2½	1 - 1⅛	
25,000	5	Great Western Electric Light & Power Co.	2½	⅞ - 1	
24,980	5	Hammond Electric Light & Power Supply Co.	2½	6 -6⅛	6⅝ m. 6¾ ⅛ ⅜ ⅛ ac.
40,000	5	Indian & Oriental Electrical Storage Works Co.	2	1⅛ - 1⅜	
172,500	1	Maxim-Weston Electric Light and Power Co.	1	⅛ - ¼	
40,000	5	Pilsen-Joel & General Electric Light Co.	2	1⅝ - 2	1⅝ ac.
..	..	South African Brush Electric Light & Power Co.	2½	¾ - 1⅛	
100,000	5	Swan United Electric Light Co., Limited	2	1¼-2⅛	2 1/16 1 15/16 m. 2 1/16 ac.
		TELEGRAPHS.			
2,116,400*l.*	Stk.	Anglo-American, Limited	100	49½- 50½	
2,441,800*l.*	Stk.	Do. Preferred } Def'd. receiving no div. until	100	80 - 81	81 m.
2,441,800*l.*	Stk.	Do. Deferred } 6 p. c. has been paid to Pref.	100	19 - 20	19⅝ ½ m.
130,000	10	Brazilian Submarine, Limited	10	12 -12¼	12⅛ m.
16,000	10	Cuba, Limited	10	9⅞- 10⅛	
6,000	10	Do. 10 per cent. Preference	10	16 - 17	
13,000	10	Direct Spanish, Limited	9	6 - 6½	
6,000	10	Do. 10 per cent. Preference	10	15½- 16½	12¼ 3/16 m.
65,000	20	Direct United States Cable, Limited, 1877	20	11¾- 12¼	
100,000*l.*	100	Do. 6 per cent. Debenture, repayable 1884	100	100 -103	
380,000	10	Eastern, Limited	10	10½-10⅝	10 11/16 ⅝ 7/16 ½ m. 10⅝ ac.
70,000	10	Do. 6 per cent. Preference	10	12⅝- 13⅛	
232,000*l.*	100	Do. 6 do. Debentures, repayable Oct. 1883	100	100 -103	
200,000*l.*	100	Do. 5 do. do. Aug. 1887	100	101 -104	
200,000*l.*	100	Do. 5 do. do. Aug. 1899	100	101 -104	
199,750	10	Eastern Extension, Australasia & China, Limited	10	11⅛- 11⅜	11 9/16 m. 11⅜ ac
320,000	100	Do. 6 p. c. Debentures, repayable Feb. 1891	100	107 -110	
500,000	100	Do. 5 p. c. (Australian Gov. Subsidy) Deb. 1900	100	102 -105	
140,000	100	Do. do. registered, repayable 1900	100	102 -105	
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	103 -106	
254,300*l.*	100	Eastern and South African Limited 5 per cent. Mort. Deb. Registered redeemable 1 Jan. 1900	100	102 -105	
345,700*l.*	100	Do. do. To Bearer	100	102 -105	
22,050	10	German Union Telegraph and Trust, Limited	10	9⅞- 10⅛	
163,390	10	Globe Telegraph and Trust, Limited	10	6⅛- 6⅜	
163,209	10	Do. 6 per cent. Preference	10	12⅛- 12⅝	12⅜ ⅜ m.
125,000	10	Great Northern	10	12⅜- 12⅝	
100,000*l.*	100	Do. 5 per cent. Debentures	100	100 -103	
31,200	10	India-Rubber, Gutta-Percha and Telegraph Works	10	27 - 28	
100,000	100	Do. 6 per cent. Debentures, 1886	100	100 -103	
17,000	25	Indo-European, Limited	25	31 - 32	
38,148	10	London Platino-Brazilian, Limited	10	4⅛- 4¼	
12,000	10	Mediterranean Extension, Limited	10	1⅞- 2⅛	
8,200	10	Do. 8 per cent. Preference	10	8 9	
9,000	8	Reuter's, Limited	8	12½- 13	
280,000	Stk.	Submarine	100	245 -255	
58,225	1	Do. Scrip	1	2⅜- 2⅝	
4,200	Cert.	Submarine Cables Trust	100	102 -106	102
37,350	12	Telegraph Construction and Maintenance	12	32 - 33	32½ m. 32½ ac.
150,000	100	Do. 6 per cent. Bonds, 1884	100	101 -104	
186,750	5	Do. 2nd Bonus Trust Cert.	5	1⅛- 1⅜	
30,000	10	West Coast of America, Limited	10	4⅞- 5⅛	
150,000	100	Do. 8 per cent. Debentures	..	.. ..	
69,910	20	Western and Brazilian, Limited	20	7⅛- 7⅜	7⅜ m. 7⅛ ⅜ ac.
200,000*l.*	100	Do. 6 per cent. Debentures "A" 1910	100	104 -107	
2,500	100	Do. 6 p.c. Mort. Deb. series B of '80. red. Feb., 1910	100	97 -100	
1,500	$1,000	Western Union of U. S. 7 p.c. 1 Mort. (Building) Bds.	$1,000	123 -128	
1,030,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	100 -103	
88,321	10	West India and Panama, Limited	10	1⅛- 1⅜	1¼ m.
34,563	10	Do. 6 per cent. 1st Preference	10	7 - 7⅛	
4,669	10	Do. 6 do. 2nd do.	10	5⅛- 5⅜	
		TELEPHONES.			
154,165	1	Con. Telephone & Maintenance, Ld. Nos. 1 to 154,165	1	1 - 1⅛	
200,000	1	Oriental Telephone Co., Nos. 100,000 to 300,000	¼	¾ - 1	
100,000	5	United Telephone Co.	5	10⅞- 11⅛	